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DEPARTMENT OF WATER RESOURCES

FEATHER RIVER AND DELTA DIVERSION PROJECTS

BULLETIN NO. 78

INVESTIGATION OF ALTERNATIVE AQUEDUCT SYSTEMS TO SERVE SOUTHERN CALIFORNIA

APPENDIX D

ECONOMIC DEMAND FOR IMPORTED WATER

EDMUND G. BROWN
Governor

HARVEY O. BANKS
Director

MARCH, 1960

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Space does not permit the listing of all these persons, but their assistance and cooperation is gratefully acknowledged. Attachment No. 1 lists the principal organizations and persons who materially contributed to this investigation.

CONSULTANTS

To assist the Department in its investigational activities connected with projections of future urban and agricultural growth, several consultants were retained to advise on specific fields of the studies. Mr. Van Beuren Stanbery of San Francisco, Economic and Population Consultant, participated in the population and employment studies from their inception, provided invaluable information on methodology and source material, and analyzed the results of these studies. Dr. David Weeks, Professor of Agricultural Economics Emeritus, University of California, Berkeley, assisted in all phases of the agricultural studies and, in addition, commented on the population and economic projections. Dr. E. T. Grether, Dean of the Graduate School of Business Administration, University of California, Berkeley, advised on procedures, sources, and scope of the investigations of economic and employment growth, and assisted in evaluations of the results.

These consultants prepared statements on their participation in the investigations which were presented to the California Water Commission on December 5, 1958. Dr. Weeks subsequently modified his statement in a letter to the Director of Water Resources, and this letter, together with the statements of Mr. Stanbery and Dr. Grether, are reproduced in Attachment No. 2.

Dr. Milton S. Baum of Sacramento State College was employed as a consultant to prepare, with staff assistance, a report on the market outlook for California crops. This report has not been published, but data therefrom have been utilized in the studies of agricultural growth and are reproduced in this report. Dr. Baum was not required to submit any statement on his activity in preparing the market outlook report.

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CHAPTER I. INTRODUCTION AND CONCLUSIONS

In furtherance of the Feather River and Delta Diversion Projects, detailed studies have been conducted to select the location of the aqueduct which would best serve the vast and ever-growing metropolitan areas of southern California. The results of these studies are reported in Bulletin No. 78, entitled "Investigation of Alternative Aqueduct Systems to Serve Southern California", dated December 1, 1959.

The contents of this appendix support the conclusions and present detailed data on the information summarized in Chapter II of Bulletin No. 78, entitled "Economic Demand for Imported Water".

The determination of the proper location and capacity of an aqueduct system necessitates estimates of when and where water would be needed and the rate of growth in demand therefor after it has been introduced. The economic demand for water, which is related to the ability of project beneficiaries to pay the cost for such water, is dependent upon the cost of serving such supplies, which in turn is affected by the location and capacity of the aqueduct system. Thus, economic demand for imported water becomes an important factor in the determination of the proper location and capacity for an aqueduct system. Results of these water demand studies are also used to test the financial feasibility and economic justification of the aqueduct system and the timing of construction of initial and subsequent units of the system.

Authorization for Investigation

Statutory authorization of the Feather River and Delta Diversion Projects is contained in Division 6, Article 9.5, of the California Water Code.

This investigation was originally authorized and funds appropriated therefor by the Legislature in 1956. The Legislatures of 1957 and 1958 subsequently appropriated additional funds for continuation and completion of the investigation. At the same legislative session that this investigation was authorized, Senate Concurrent Resolution No. 19 was passed which directed the then Division of Water Resources of the Department of Public Works to study routes through San Bernardino and Riverside Counties in connection with its investigation of alternative aqueduct routes to San Diego County and to report thereon to the Legislature in 1957.

Scope of Investigation

The scope of the investigation was directed towards providing estimates of the economic demand for imported water in southern California. These estimates were made for a period of time extending sufficiently far into the future, so as to develop the magnitude and character of relatively long-term water needs. The period so chosen was from the present to year 2020. A period of analysis of considerable length is required to assure proper selection of the economic size and location of an aqueduct system to serve the investigational area which comprises the water deficient southwesterly portion of California.

The area, herein called the southern California area, includes the west and southerly portions of Kern County, San Luis Obispo, Santa Barbara, Ventura, and Orange Counties, the coastal segments of Los Angeles, Riverside San Bernardino, and San Diego Counties, together with the Antelope-Mojave and Whitewater-Coachella desert areas. The general location of the area is shown on Plate 1, "Location of Investigational Area".

Determination of the economic demand for water in this area necessitated consideration of both the probable growth of population and related industry and commerce, as well as future changes in irrigated agriculture. The population and economic studies included evaluations and projections of national and regional data as well as State and local data, and the agricultural studies emphasized local factors while including considerations of national markets for products and the competition therefor.

Estimates of the forecast water needs for these basically different purposes were arrived at by analyzing individual subunits of the area which are as small geographically as was deemed practicable. The 186 subunits which were investigated within the southern California area are shown on Plate 2, entitled "Boundaries of Service Areas and Subunits". These subunits were subsequently grouped into the water service areas as shown on the plate.

The southern California area as shown on Plate 2 comprises an area of about 30,000 square miles with a present population of about 8.7 million, over half that of the State. It has a present irrigated area of 1.4 million acres which produces agricultural products with a gross value in excess of one billion dollars. The area offers extreme contrasts in development, varying from the rich agricultural valley lands of Kern County to the highly industrialized and rapidly growing metropolitan centers of Los Angeles and San Diego.

The southern California area is a major contributor to the nation's economy. In the United States during 1956, only the States of California and Texas had a mineral production valuation greater than that of this area. In 1957, the southern California area produced minerals valued at nearly $1.3 billions or 78 per cent of the State total. In manufacturing, the area's nearly 900,000 employees represented over five per cent of manufacturing employees in the United States in 1957. From 1949 to 1957, manufacturing employment in the area increased 107 per cent while United States manufacturing employment increased only 18 per cent. The financial strength of the area is indicated by the fact that 1957 taxable sales exceeded 8 billion dollars and the center of the area, the Los Angeles metropolitan area, surged past the Chicago metropolitan area to become the second largest retail center in the nation.

Water Supply Conditions in Southern California Area

With a few exceptions, local water resources in the southern California area are fully developed. South of the Tehachapi Mountains, local water supplies are augmented by importations from the Owens-Mono Basin by the City of Los Angeles and from the Colorado River by The Metropolitan Water District of Southern California. In the San Joaquin Valley, the Central Valley Project of the United States Bureau of Reclamation supplies water from the San Joaquin River to the eastern portions of Kern County. Despite the existence of these great projects, the economic development of a substantial portion of the west side of the San Joaquin Valley is either subsisting on ground water overdraft or development has not been possible through the lack of a water supply. Annual overdraft in the southern California area aggregates about one million acre-feet, consisting of approximately 300,000 acre-feet in the South Coastal Area, 100,000 acre-feet in the Antelope-Mojave Service Area, between 40,000 and 80,000 acre-feet in the Whitewater-Coachella Service Area, and 540,000 acre-feet in the Kern County Service Area.

There is an increasing public awareness of these dwindling ground water reserves. Continuing and progressive lowering of ground water levels with increased pumping costs, intrusion of sea water in coastal areas, and physical exhaustion of water in other areas have stimulated an ever increasing use of imported water, where available. South of the Tehachapi Mountains this has been reflected in continued annexations to The Metropolitan Water District of Southern California. Restrictions on use of local ground water supplies by both voluntary action and court decree have been effected in a few areas, and in such cases, supplemental water demands are met through the increased use of imported water.

The claimed rights of The Metropolitan Water District of Southern California to waters of the Colorado River amount to 1,212,000 acre-feet per annum. In 1950-51, the District sold 167,000 acre-feet of water to its member agencies. In 1957-58, sales of Colorado River water by the District had increased to about 540,000 acre-feet, which represents an average annual increase of about 53,000 acre-feet.

It is apparent that the Colorado River supply will be put to full use in the near future and that an additional source of water will be needed in the Metropolitan Water District service area. Further, Colorado River water is not available to all areas of need south of the Tehachapi Mountains, including Ventura County, or to the coastal counties of Santa Barbara and San Luis Obispo. In portions of these areas, supplemental imported water could be utilized at the present time.

A similar situation prevails in Kern County, where the stability of the existing economies of the Semitropic Water Storage District and the Wheeler Ridge-Maricopa Water Storage District is dependent on the availability of imported water in the near future. Central Valley Project water is not available to these areas, as the full supply of the Friant-Kern Canal is already committed to a service area situated along the eastern side of the valley. It is interesting to note that ground water pumping lifts in much of southern Kern County presently exceed lifts that prevailed in the northeastern portions of the county at the time that imported water was introduced via the Friant-Kern Canal.

The varying water supply conditions existing throughout the southern California area may be grouped into eight different situations. These situations and the possible effects of the prevailing water supply conditions on the probable future demand for imported water are discussed briefly in the following paragraphs:

1. Inadequate or no surface or ground water supplies are available, which condition occurs in the Antelope Plain in Kern County and portions of Santa Barbara and Ventura Counties. These areas are restricted to an economy based upon dry-land grazing of livestock and dry-land farming

until the time that imported water supplies become available. The large potential for growth of irrigated agriculture in the Antelope Plain and large potential for growth of urban centers in the other areas is dependent upon the availability of imported supplies.

2. Local surface and ground water supplies essentially are fully developed with the existing level of economic development dependent on a continuing supply of imported water from presently adequate sources. This is the situation in San Diego and southwestern Riverside Counties. Large portions of these areas are irrigable but little irrigation was practiced until the very recent advent of imported water supplies with the result that there is a very large potential for increase in irrigation within the area. The future growth of the areas and the stability of the existing economy, both urban and agricultural, is largely dependent on the continuing availability of imported water.

3. Ground water is available with extractions less than safe yield, a condition which presently exists in the Upper Salinas and Lompoc Valleys. Both urban and agricultural growth in these areas generally will be unaffected by lack of imported water supplies in the near future. After local urban and agricultural growth utilizes the full potential of all local water supplies, further growth will be dependent upon imported water.

4. Local surface supplies are fully utilized and extractions from ground water are exceeding safe yield with no source of supplemental water presently available. This occurs in the Antelope-Mojave Service Area, Santa Maria Valley, and portions of Kern County. Realization of the full growth potential of these areas is dependent upon the availability of imported water. If imported water is not available prior to the time that ground water supplies reach the limit of economic pumping lifts or are fully depleted, the present economic structures will be seriously impaired.

5. Local surface supplies are fully utilized and extractions from ground water are exceeding safe yield with some imported water from a presently adequate source being used. This condition exists in the Central Basin area of Los Angeles County. As imported supplies are now available and being used to some extent, the present overdraft will probably continue for some years into the future until extractions are limited due to

recognition of the impending danger to utility of the ground water basins, either voluntarily or by court action. The extent to which future water supplies are obtained by overdrawing ground water will affect the demand for imported water.

6. Extractions from ground water are exceeding safe yield and development of limited additional surface water supplies is a feasible possibility, as in portions of San Luis Obispo and Ventura Counties. The potential for future development of local surface water supplies decreases the quantities of imported water which would otherwise be necessary. As the utilization of these supplies is dependent upon local initiative, assumptions of the quantities and timing of development of local water supplies are required. These assumptions affect the design of aqueducts to carry imported water to these areas, and this condition should be recognized.

7. Extractions from ground water are exceeding safe yield with imported water from a presently adequate source being available but unused. This condition exists in certain areas in coastal Los Angeles, San Bernardino and Riverside Counties. These areas, adjacent to the Metropolitan Water District, could obtain imported water by following the procedures necessary for joining this District at this time. All future demands for imported water will be affected by the assumption followed in considering when, if ever, the various areas will join this District.

8. Utilization of local ground water is limited by court decree, stipulation, or by voluntary action with supplemental water requirements being met either partially or completely with imported water. This occurs in the West Coast Basin and Raymond Basin Area in Los Angeles County, and in the greater portion of Orange County. All water requirements in these areas in excess of allowable extractions as determined by stipulations, court decrees, and by local agencies are being met by purchases of imported water in the respective areas.

Prior Report

In compliance with Senate Concurrent Resolution No. 19 and with Item 419.5 of the Budget Act of 1956, the Department pursued an accelerated program of investigation and published in the spring of 1957, Bulletin No. 61, "Feather River Project - Investigation of Alternative Aqueduct Routes to San Diego County". This report contains projections of population, irrigated agriculture, and water demands for coastal San Diego County, southwestern Riverside County, and subunits of these areas. The projected demands for imported water reported therein served as the basis for sizing and staging the construction of an aqueduct originating at the westerly portal of San Jacinto Tunnel on the Colorado River Aqueduct of The Metropolitan Water District of Southern California and extending south a distance of about 104 miles through southwestern Riverside and coastal San Diego Counties. This aqueduct initially would deliver Colorado River water, but at such times as water from northern California becomes available, could also be utilized for delivery of this water. Subsequent to the publication of Bulletin No. 61, The Metropolitan Water District of Southern California and the San Diego County Water Authority proceeded with the financing and have initiated construction of this aqueduct in general conformance with the recommendations contained in that bulletin.

Following the completion of the studies published in Bulletin No. 61, investigations of the future economic demands for imported water in the investigational area have continued. The results of these studies, and a summary of procedures and assumptions followed, were presented to the California Water Commission on December 5, 1958, in a mimeographed statement.

Additional copies of this statement are no longer available for distribution, but the material contained therein is amplified in this report.

As a result of the extensive investigations of the future population of California and its counties pursued subsequent to the studies reported in Bulletin No. 61, the population projected for San Diego County has been increased somewhat over estimates set forth therein. However, these detailed studies have indicated that the projected demands for imported water, as reported in Bulletin No. 61, are still valid.

Conduct of Investigation

The investigations leading to projections of demands for imported water required both field and office work extending over a period of two and one-half years. The contrasting nature of various portions of the investigational area with respect to available water supply, type of present and anticipated economy, level of existing development, and other pertinent factors necessitated individual and separate consideration of the 186 subunits of the area.

Hundreds of organizations and individuals were contacted throughout the investigational area and the State to obtain data and opinions relative to the need for water, ability to pay for water, present uses and costs of existing supplies, forecasts of economic conditions as regards specific sectors of industry and agriculture, and the industrial and commercial complex as a whole, and other related matters. The organizations and persons who were of assistance to the Department are listed in Attachment No. 1.

Three consultants were engaged to advise the Department staff on those phases of the work concerning the determination of economic demand for imported water. Dr. David Weeks, Professor of Agricultural Economics Emeritus of the University of California, was consulted on development of irrigated agriculture; Van Beuren Stanbery of San Francisco, a well-known economist and demographer, advised on the projections of population and employment; and Dr. E. T. Grether, Dean of the Graduate School of Business Administration of the University of California, Berkeley, advised on future industrial and commercial developments. Upon completing the studies, these consultants prepared independent statements summarizing their activities with this investigation and commenting on the results. These statements are reproduced in Attachment No. 2.

In 1957, the Department of Water Resources entered into a contract with the firm of Booz, Allen and Hamilton, Management Consultants, to investigate and prepare a report on the economic potential of the Antelope-Mojave area in Kern, Los Angeles, and San Bernardino Counties. Estimates of economic demand for water in this area were based in part on data and conclusions contained in this firm's report, published as Appendix A of Bulletin No. 78, and entitled "Long Range Economic Potential of the Antelope Valley-Mojave River Basin, January, 1959".

Liaison was maintained with responsible local agencies through meetings with an Engineering Advisory Committee composed of officials and representatives of water agencies and political entities throughout the southern California area. These periodic meetings were held to review the progress and to discuss techniques and procedures utilized in the investigation. Valuable advice and comment has been received from this committee.

Basic Planning Assumptions

Preparation of estimates dealing with events which will occur in the future necessarily contain an element of conjecture. With respect to the nature and magnitude of future development, this element of conjecture can be minimized substantially by recognition and careful evaluation of historical trends and presently established policies and patterns.

In developing the estimates of economic demand for water, these trends, policies, and patterns were analyzed separately for the area as a whole and for each subdivision thereof. Based on these analyses, assumptions were developed and employed with respect to future conditions which are believed to reflect policies of reasonableness and conservatism. It is therefore considered that the future conditions predicted for the southern California area have a high probability of occurrence. Moreover, likely variations from the predictions would tend toward increasing rather than reducing forecast water demands.

The principal underlying assumptions employed in developing the estimates are set forth and discussed in the following paragraphs:

1. Surplus northern California water is a supplemental and not a substitutional water supply. By this assumption, preference would be given to the utilization of local surface and ground water supplies over northern California water insofar as the use of these supplies indicated economic and/or financial advantage. Thus, it was not arbitrarily assumed that predicted overdrafts, at the time northern California water would become available in various areas, would be immediately overcome by use of this imported water. Rather, individual consideration was given to each area

with respect to local attitudes, policies of governing political entities, and costs of continuing the over-exploitation of ground water with resultant hazards. Full recognition was given to conditions extant in those areas where local ground water extractions have now been limited by local voluntary action or by court decree.

2. A water supply adequate in quantity and quality will be available to meet forecast economic demands. This underlying assumption is inherent in the preparation of any estimate of water demand. With selection of one or the other of the basic alternative aqueduct routes under consideration, i.e., coastal or an inland route, many parts of the investigational area could not feasibly receive water service, or such service would be substantially delayed or more costly. Thus, it was obvious that the magnitude, timing, and rate of growth in demand for northern California water is to a certain extent a function of aqueduct route selection. However, since it is a primary purpose of the over-all investigation to determine the relative costs and accomplishments of the alternative routes and select one route or routes from the alternatives, no presumption as to which route would be constructed could be made. As a result, the basic estimates of growth in economic demand for water in each component service area reflect the assumptions of availability of water from the alternative aqueduct that would provide water thereto at the least cost. In this manner, it was possible to reflect in the comparative analyses of alternative aqueducts differences in magnitude of water service and the benefits arising therefrom.

3. Initial deliveries of surplus northern California water physically could be made to the San Joaquin Valley in 1965 and south of the Tehachapi Mountains and to the coastal counties in 1970. The physical availability of northern California water to areas of need in the southern California area and the timing of delivery thereof will be dependent on aqueduct system selection, construction capability, and upon the reconciliation of many matters beyond the scope of this report, the outcome of which cannot be forecast at this time. Further, a construction timetable, once established, may be varied by unforeseen difficulties or circumstances. The foregoing assumptions as to time of availability of water are based upon an accelerated construction timetable for the aqueduct facilities which could not be exceeded in any significant degree without loss in efficiency and increase in cost. It should be recognized that all parts of the coastal counties and all lands south of the Tehachapi Mountains could not possibly be served with northern California water by 1970, nor would all such areas have an economic demand for this water at that time.

4. The full cost of water at the main aqueduct involved in delivering water to each service area, including full recovery of capital cost with interest, is the proper basis for estimating economic demands for supplemental water for purposes of aqueduct system selection and preliminary design. The term "growth in economic demand for water" connotes a relationship between demand and price of water. At the present time, the pricing schedule for water to be delivered under the San Joaquin Valley-Southern California Aqueduct System has not been nor can it now be established. It is not the purpose of this investigation to establish a pricing schedule but rather to estimate the

future demand for water by areas on a conservative basis. The assumption employed is believed to result in reasonable estimates, particularly with respect to the development of and demand for water by irrigated agriculture. In Chapter VI, there are presented the results of estimates of variation in projected irrigated agricultural development with price of water.

As stated in the assumption, the price of water was taken as its cost in estimating the growth in demand for imported water. These costs represent, for each area, service from that aqueduct system delivering water thereto at the least cost. The costs used in deriving the economic demand for imported water reported herein are as follows:

Service area	Cost at the aqueduct in dollars per acre-foot
Kern County	
Upper Antelope Plain	16
Avenal Gap to Pumping Plant In-III	10
Pumping Plant In-III to Pumping Plant In-IV	16
Pumping Plant In-IV to Pumping Plant In-VI	24
San Luis Obispo	26
Santa Barbara	27
Ventura County	49
Antelope-Mojave	38
Whitewater-Coachella	52
Southern California Coastal Plain and Coastal San Diego County	43

The method of determining the foregoing costs was presented in Bulletin No. 78. In addition to these costs, the estimated costs of distributing water within service areas, as reported in Bulletin No. 78, were reflected in the demand projections.

Individual consideration was given to the present service area of The Metropolitan Water District of Southern California with recognition of present pricing policies of the District under the assumption that these policies would prevail in the future. A direct charge to the user of $30 per acre-foot was assumed in projecting development in the District area. It is assumed that the District would recover the difference between this charge and the $43 cost of water in the main aqueduct under its present procedure of taxation, or otherwise. This value represents an estimated average charge that might be assessed in the future for both Colorado River water and northern California water. In the District area, these two sources of supplemental water must be considered together.

5. The full claimed right of The Metropolitan Water District of Southern California to Colorado River water will be available to its present service area. This claimed right amounts to 1,212,000 acre-feet annually. Estimated losses in delivery leave a net amount available for water service of about 1,150,000 acre-feet annually. This supply of water was considered available for use only by the present District agencies and no annexations of additional agencies were postulated. It is recognized that such annexations may occur, and, if this happens, it will serve to advance the date of full utilization of the Colorado River water supply in the District area.

Conclusions

As a result of the investigation of the economic growth of demands for imported water in the southern California area conducted as a part of the investigation of alternative aqueduct routes to southern California, it was concluded that:

1. The phenomenal growth of population and industry in recent years in southern California may be expected to continue if provision is made for an adequate supply of water.

2. Surplus northern California water will be required to sustain the economic development of the southern California area after 1970. By that date, only eleven years away, the water needs of expanding population and industry will have fully utilized the entire claimed right of The Metropolitan Water District of Southern California to Colorado River water.

3. The annual supply of 1,800,000 acre-feet of water proposed for delivery to the area south of the Tehachapi Mountains under Feather River Project water right filings will be fully utilized about twenty years after the first deliveries are made to southern California.

4. By 1980, nearly 17 million of California's projected 28 million persons will live in the nine southern California counties of Los Angeles, Orange, Riverside, San Bernardino, San Diego, Ventura, Santa Barbara, San Luis Obispo and Kern. This is about twice the present population of these counties. In the year 2020 the population of these counties will have tripled to about 28.5 million out of a projected State population of 56 million. In most of the nine counties, irrigated agriculture will continue to decline as urban areas expand. A significant exception to this would be in Kern County where an increase in irrigated agriculture of 462,000 acres is predicted.

5. Expansion of urban areas will bring about virtual exclusion of agricultural activity in coastal portions of Los Angeles, San Bernardino and Orange Counties by the turn of the century. However, southwestern

Riverside and coastal San Diego counties, which have been relatively slow to develop because of limited water supplies, are expected to increase from a present irrigated area of 61,000 acres to about 178,000 acres by year 2020.

6. By 1980, the demand for surplus northern California water south of the Tehachapi Mountains will be nearly one million acre-feet per year. This requirement will rise to 1.75 million acre-feet by 1990 and about 3.5 million acre-feet by 2020, at which time the area will be essentially fully developed. For the present service area of The Metropolitan Water District of Southern California, demands for surplus northern California water will be about 600,000 acre-feet in 1980, about 1.0 million acre-feet in 1990, and about 2.0 million acre-feet per year by the year 2020.

7. Demands for surplus northern California water in the year 2020 will be as follows: South Coastal Area from Ventura County to the Mexican Border, 3,190,000 acre-feet; the Antelope-Mojave and Whitewater-Coachella Service Areas, 308,000 acre-feet; Santa Barbara and San Luis Obispo Counties, 250,000 acre-feet; Kern County Service Area, 1,800,000 acre-feet.

CHAPTER II. LAND AND WATER RESOURCES

Two of the most basic natural resources of any area are its usable land and available water supplies. As this nation becomes increasingly urbanized, the exploitation of other natural resources, such as timber and minerals, loses its prior significance. At the same time, the major metropolitan centers' futures are becoming more dependent upon the availability of both land for expansion and water to support the resulting economy. In evaluating the economic development of the southern California area, both of these basic natural resources were investigated.

Inventory of Land Resources

In addition to the physical availability of land, its topographic and surface soil characteristics must be measured in determining the acreages usable for irrigation or habitation. Accordingly, lands within the southern California area were evaluated with respect to their adaptability for various water-using developments. The immediate future patterns of use of the available lands are greatly influenced by the existing type and areal extent of land utilization. Therefore, in addition to classifying lands for their potential use, determinations were made of the present levels of such development.

Land Classification

All lands in the investigational area were reviewed and classified with respect to their suitability for urban and irrigated agricultural development, using standards of classification previously defined by the Department in Bulletin No. 2 and subsequent reports. In general, land classifications determined in connection with investigations for the California water plan were utilized. In San Luis Obispo County, this land classification had been refined as a result of the detailed county-wide water resources studies made by the Department. Where land resources appeared to be critical, i.e., the available usable lands were less than the probable requirements therefor, or where the previous surveys reported in these bulletins did not analyze the area in the detail required, the lands were reclassified in the field to insure an accurate determination of available acreage for future development. For this reason, new surveys were conducted in San Diego County, coastal Riverside and San Bernardino Counties, the south coastal portion of Santa Barbara County and the San Joaquin Valley portion of Kern County, during 1956, 1957, and 1958.

Results of the land classification surveys are shown in Table 1 and portrayed on Plate 3, entitled "Present and Potential Land Classification", sheets one to eight. Detailed results of these surveys by subunits are tabulated in Attachment No. 3, consisting of Tables 62 through 69. As seen on sheet 7 of Plate 3, a classification of the Whitewater-Coachella Service Area lands was not made. This area encompassed some 850 square miles, most of which are habitable. Inasmuch as only urban expansion is anticipated in this area, and the acreage is adequate for a population of several million, it was concluded that projections of urban population and water requirements did not necessitate a land classification survey therein.

TABLE 1

CLASSIFICATION OF IRRIGABLE AND HABITABLE LANDS

(Net areas in acres)

Region	Irrigable or habitable								Lands not susceptible of development	Total land areas
	Valley lands	Gently sloping hill lands	Steeply sloping hill lands	Urban lands	Agri-cultural Resi-dential lands	Miscel-laneous lands	Undiffer-entiated irrigable or habitable lands	Subtotal		
San Luis Obispo Service Area	144,600	148,800	92,500	59,000	100	19,400	---	464,900	1,672,100	2,137,000
Santa Barbara Service Area	---	---	---	85,900	26,400	90,100	166,000	368,400	1,274,600	1,643,000
TOTALS	144,600	148,800	92,500	145,400	26,500	109,500	166,000	833,300	2,946,700	3,780,000
Southern California Coastal Plain and Coastal San Diego County Service Area										
Coastal Los Angeles County	---	---	---	---	---	---	808,700	808,700	---	808,700
Orange County	---	---	---	---	---	---	332,600	332,600	---	332,600
Coastal Riverside County	124,900	95,900	43,400	197,700	18,000	3,900	---	483,800	660,400	1,144,200
Coastal San Bernardino County	8,000	12,800	4,400	230,800	3,000	14,700	---	273,700	375,900	649,600
Coastal San Diego County[a]	105,300	113,600	145,800	346,800	1,700	400	---	713,600	1,008,900	1,722,500
TOTALS	238,200	222,300	193,600	775,300	22,700	19,000	1,141,300	2,612,400	2,045,200	4,657,600

CLASSIFICATION OF IRRIGABLE AND HABITABLE LANDS
(continued)

(Net areas in acres)

Region	Irrigable or habitable								Lands not susceptible of development	Total land areas
	Valley lands	Gently sloping hill lands	Steeply sloping hill lands	Urban lands	Agri-cultural residential lands	Miscel-laneous lands	Undifferentiated irrigable or habitable lands	Subtotal		
Ventura County	---	---	---	147,200	46,700	7,800	9,600	211,300	970,700	1,182,000
Kern County Service Area	1,023,000	51,800	11,900	75,400	---	---	---	1,162,100	24,900	1,187,000
Antelope-Mojave Service Area	---	---	---	---	---	---	3,100,000	3,100,000	1,783,000	4,883,000
Whitewater-Coachella Service Area	---	---	---	---	---	---	---	---	---	---

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a. Includes that portion of coastal San Diego County for which a detailed survey was made as reported in Bulletin No. 61.

Methods and Procedures. Field mapping was done on aerial photographs having a scale of approximately 1:20,000. Stereoscopes were used to assist the field men in making delineations in accordance with observed conditions. As the appropriate classification for each parcel of land was determined, it was delineated on the aerial photograph.

After completion of field mapping on aerial photographs, the delineations were transferred to U. S. Geological Survey quadrangles. This procedure was necessary in order to accurately determine the acreage of the various classifications because of the wide variation in scale of the aerial photographs. Following transfer of the data to quadrangle sheets, the acreage of each of the classifications was determined by cutting the delineated areas and weighing them with an analytical balance.

In making the land-classification survey, the lands were segregated into four broad general classifications according to the nature of their expected future development. These four categories are (1) Irrigable Lands; (2) Urban Lands; (3) Recreational Lands; and (4) Lands deemed to be unsuitable for any of the above classes. Detailed descriptions of the classes used in the survey are listed in Attachment No. 1. A brief discussion of the classes follows:

1. Irrigable Lands. The irrigable lands were grouped into appropriate classifications according to their suitability for development under irrigated agriculture and their crop adaptability. These classes were based, to a large extent, on present agricultural practices and provided a direct approach in estimating the future crop pattern.

   There are many factors which influence the suitability of land for irrigation development. Some of the indirect ones are those economic factors related to the production and marketing of climatically adapted crops, location of the land with respect to a water supply, and climatic conditions. Since economic conditions are variable among given areas and are subject to considerable fluctuation over a period of time, no consideration was given them in the determination of irrigable lands. Neither was the position of the lands as related to a water supply, an influencing factor in the classification. However, these factors (including climatic conditions), while not considered in the physical classification of the lands, were very important in determining the probable future cropping pattern as discussed in Chapter IV.

Since it is the physical characteristic of the land and the inherent conditions of the soil itself that directly affect the suitability of land for irrigation development, these were the factors considered in the classification of irrigable lands. This consisted basically of an examination of the soil characteristics and the physiography of the landscape.

In dividing the irrigable lands into crop-adaptability classes, they were first segregated into three broad topographic groups; smooth-lying valley lands, gently sloping and undulating lands, and steeper and more rolling lands. Where other conditions were present that affected the suitability of the lands to produce climatically adapted crops, the three broad topographic classes were further subdivided in accordance with the nature of the conditions. These limiting conditions included shallow soil depths, rockiness, high-water tables, coarse textures with a low moisture-holding capacity, very fine textures which limit the effective root depth, and the presence of soluble salts or exchangeable sodium.

The character of the soils was established by examination of road cuts, ditch banks, and material from test holes, together with observation of the type and quality of native vegetation and crops. The presence of rock, high-water tables, salinity, and alkalinity were observed. Representative slopes throughout the area were measured with a clinometer to determine their degree of slope. By giving consideration to all these factors, the appropriate crop-adaptability class for each parcel of irrigable land was determined and delineated on the aerial photograph.

In certain areas covered by this survey, work done by other agencies was of value in mapping the irrigable lands. The Soil Conservation Service of the United States Department of Agriculture has made detailed land-capability surveys for the soil conservation districts, and the Bureau of Reclamation of the United States Department of the Interior has made land-classification studies in connection with federal reclamation projects.

The surveys of both these agencies were used to supplement the work of the Department of Water Resources. In addition, the soil surveys of the University of California and the United States Department of Agriculture aided in the classification procedure.

Extensive acreages of highly alkaline lands exist in the Kern County Service Area. As the cost of reclaiming this type of land is an important factor in influencing the rate at which development will proceed, samples of alkali soils were subjected to laboratory determinations of their chemical as well as their physical characteristics. Estimates of the quantity of gypsum and leaching water required to reclaim these soils for adaption to the growth of selected agricultural crops, and the cost of such reclamation, were then derived by soil technologists.

2. Urban Lands. It was recognized that rather large areas of land would be necessary to accommodate the expansion of urban development resulting from continued rapid increases in California's population as discussed in Chapter III. In view of this, a large part of the area covered by the surveys was placed in an urban class. It is doubtful, however, if agriculture will be entirely replaced by urban development for many years. Some agriculture still exists in areas where the urban pressure is greatest.

   In classifying and mapping the lands judged to have a potential for intensive urban development, including residential, commercial, and industrial use, no attempt was made to determine which lands (nor in what amounts) might be devoted to any one of these uses. Rather, these lands were classified simply as urban. However, where it was anticipated that future urban development would consist primarily of suburban residential areas with few or no industrial or commercial enterprises, the lands were given a suburban classification. This suburban class was further subdivided into high and low water-using categories. It was also believed that certain lands would be devoted to a combination of agricultural and residential development with maximum size of individual parcels being five acres, and these lands were so classified.

3. Recreational Lands. In view of the ever-increasing population, it was recognized that there will be a demand for considerable areas for recreational purposes. This is particularly true of the mountainous regions where this type of development is expanding rather rapidly at the present time.

   The potential recreational lands were grouped in four classes: permanent and summer home tracts; commercial area; camp and trailer sites; and parks. Obviously, all of the mountainous lands are suitable for some recreational use such as hunting, fishing, and other sports of this nature. For the purpose of this investigation, however, consideration was given only to those lands where some fairly intensive development might occur which would require water service.

4. Lands deemed to be unsuitable for any of the above classes. These lands are inaccessible wild areas, mountain areas with slopes too steep to be used, areas where soil conditions preclude the use of the land, military reservations, and remote areas that have no natural water supply and will be unable to import water in the foreseeable future.

Land Use

Surveys were conducted to determine present land use in most of the areas during 1957 and 1958. In coastal Los Angeles County, a survey made in 1955 was available, and in San Luis Obispo County, a 1953 land use survey was available. The same general procedures for field mapping and tabulating, as previously described under land-classification methods and procedures, were used in making the land-use surveys. Also, comparable general categories were used in grouping the present land uses, namely agricultural, urban, recreational, and native vegetation. In the agricultural class, the individual kind of crop was shown and designated as either irrigated or nonirrigated. In the urban and recreational classes, the same breakdown was used as in the land-classification survey, with the present development, rather than the ultimate, being mapped. In Ventura County, however, the land use survey was made by up-dating, in the field, maps containing a cultural survey conducted in 1950, rather than by working from aerial photographs. The various areas of land use were obtained by planimetering these maps.

The present land use is shown on Plate 3, sheets 1 to 8. Detailed results of these surveys by subunits are contained in Attachment No. 4, Tables 70 through 79. In the South Coastal Area, the recent surveys show a spectacular encroachment of urban land on irrigated, dry farmed, and range lands since the area was mapped in about 1950 in connection with the preparation of the California Water Plan. Tables 2 and 3, respectively, present the results of the surveys and the comparisons thereof with the previous surveys.

The acreages required for the projected populations and irrigated crops, as reported in succeeding chapters, were located in the service areas for 1980 conditions. This period was selected to show the expected development of land within several years of the availability of northern California water. These estimates of the approximate location and extent of urban and agricultural land use in 1980 are shown on Plate 3 as overlays of present land use and land class. As these estimates demonstrate, most of the habitable land in the Los Angeles Metropolitan Area will have been developed to urban uses by that time. The expansion of irrigated agriculture as stimulated by the importation of water in Kern, San Diego, and southwestern Riverside Counties is also vividly indicated on Plate 3.

TABLE 2

PRESENT WATER SERVICE AREAS

(Gross areas in acres)

Region and year of survey		Irrigated lands						Urban, suburban and military[a]	Total water service area
		Citrus and sub-tropical	Deciduous fruits nuts and vines	Alfalfa and pasture	Truck crops	Field crops	Subtotal		
San Luis Obispo Service Area[b]	1953	0	500	13,800	3,900	4,300	22,500	5,600	28,100
Santa Barbara Service Area[c]	1957	11,600	2,700	15,000	29,300	20,100	78,700	12,800	91,500
Ventura County	1957	52,100	17,200	3,500	47,100	3,300	123,200	26,100	149,300
Coastal Los Angeles County[d]		31,500	5,200	29,800	20,300	4,900	91,700	457,900	549,600
Orange County	1957	50,900	1,100	6,900	21,400	21,500	101,800	69,200	171,000
Coastal Riverside County[e]	1957	23,400	12,900	27,000	22,200	13,400	98,900	29,500	128,400
Coastal San Bernardino County	1957	36,300	20,200	12,200	15,000	2,100	85,800	53,600	139,400
Coastal San Diego County	1958	37,500	2,700	14,200	17,400	7,700	79,500	70,800	150,300
Kern County Service Area	1958	0	3,600	99,700	15,000	235,000	353,300	29,300	382,600
Antelope-Mojave Service Area	1957	0	1,800	70,600	2,200	28,500	103,100	12,400	115,500
Whitewater-Coachella Service Area	1958	14,500	13,300	10,800	11,300	15,200	65,100	10,600	75,700

a. Large military reservations in San Luis Obispo, San Diego, and Santa Barbara Counties, and in Antelope-Mojave Service Area not tabulated.

b. Net areas in acres.

c. 7,300 irrigated acres in the Santa Maria Valley Water Conservation District within San Luis Obispo County are tabulated with Santa Barbara Service Area.

d. Water service areas herein are summation of 1957 field survey in Newhall Study Area and 1955 field survey in Coastal Plain.

e. Water service areas herein are summation of 1957 field survey in Upper Santa Ana Valley and 1958 field survey in Santa Margarita River watershed.

TABLE 3

COMPARISON OF PRESENT AND 1950 WATER SERVICE AREAS

(Values in acres)

Region and year of "present" survey	Irrigated lands			Urban lands		
	1950	Present	Change 1950 present[a]	1950	Present	Change 1950 present
San Luis Obispo Service Area - 1953	26,500	22,500	(4,000)	4,800	5,600	800
Santa Barbara Service Area - 1957	77,900	78,700	800	8,200	12,800	4,600
Ventura County - 1957	115,000	123,200	8,200	25,000	26,100	1,100
Coastal Los Angeles County - 1955 - 57	142,000	91,700	(50,300)	385,000	457,900	72,900
Orange County - 1957	136,000	101,800	(34,200)	28,000	69,200	41,200
Coastal Riverside County - 1957 - 58	100,000	98,900	(1,100)	23,300	29,500	6,200
Coastal San Bernardino County - 1957	94,500	85,800	(8,700)	34,500	53,600	19,100
Coastal San Diego County - 1958	64,200	79,500	15,300	51,600	70,800	19,200
Kern County Service Area - 1958	296,000	345,400	49,400	16,100	25,600	9,500
Antelope-Mojave Service Area - 1957	98,800	103,100	4,300	3,900	12,400	8,500
Whitewater-Coachella Service Area - 1958	31,800	65,100	33,300	4,200	10,600	6,400

[a] Parentheses denote decrease from 1950 to present.

Inventory of Water Resources

The quantities of water needed by the southern California area from northern California are a function of the magnitude and dependability of local and imported water supplies, either presently developed or economically feasible of development. Not only does the magnitude of these local and imported supplies control the demands for northern California water but the availability of local supplies, even on a short-term overdraft basis, acts as a stimulus to economic development. Thus, it was necessary to analyze local and presently imported water resources as an important factor in the potential for urban and agricultural growth in each subunit.

The development of additional water supplies in the southern California area from other sources than those located in northern California has been suggested. These potential sources of water also have been evaluated in comparison with the utilization of northern California water.

Importation from Existing Sources

Large water importation projects have been constructed in the past and are now delivering water to various portions of the southern California area. The Friant-Kern Canal of the Federal Central Valley Project supplies substantial quantities of water to the north central portion of Kern County. However, water service from this canal is not provided to, nor is contemplated for, the westerly and southerly portion of this county.

The Los Angeles Aqueduct, which has been in operation for many years, brings water from the Owens-Mono Basins to the City of Los Angeles. The aqueduct is capable of delivering an average of about 320,000 acre-feet per year and has been operated for the past several years at essentially full capacity.

The Coachella Valley County Water District has been distributing Colorado River water to its service area in Improvement District No. 1. Additional quantities of imported water, which would be needed in portions of the Whitewater-Coachella Service Area outside of the improvement district, primarily for urban growth, must be supplied from other sources.

Colorado River water is also served to a substantial portion of the South Coastal Area through facilities of The Metropolitan Water District of Southern California. As has been stated, the claimed rights of the District in and to waters of the Colorado River amount to 1,212,000 acre-feet per annum. In 1957-58, sales of Colorado River water by the District amounted to about 540,000 acre-feet. The rights of California agencies in and to the waters of the Colorado River are now in litigation instituted by Arizona.

Local Water Supplies

Estimates were prepared of the magnitude of present and probable future local water supplies available to each study area and its subunits. Estaimtes were based upon Department of Water Resources bulletins, United States Geological Survey water supply papers, reports of cities, districts, and counties, and any other available data. In addition, a special geological and hydrological investigation was conducted in Kern County to determine local water supplies available therein.

This study in Kern County concluded that the Kern River constitutes the principal source of water supply available to the Kern County Service Area. It is at present fully utilized, however, either through direct surface diversion or by pumping from ground water aquifers replenished by the Kern River. Nevertheless, the ground water basin does constitute a temporary source of additional supply as indicated by present extractions being far in excess of natural replenishment rates. To determine the extent of usable water available in subsurface storage within economic pumping lifts, which is a measure of this temporary supply, approximately 1,300 well logs were analyzed in a study of the ground water storage capacity and quantity of usable water in ground water storage in the Kern County Service Area. Storage capacity and availability of water in storage were determined for depth zones from the ground surface to a depth of 1,000 feet or to the base of fresh water, whichever was the shallower. Analysis was extended to this depth in order to encompass probable limits of economic lift. It should be borne in mind that present lifts exceed 450 feet in some parts of the study area, and that some farming operations to the north, in the San Luis area, are based on lifts of more than 800 feet. As a result of these studies, the following quantities of usable water supply in storage underlying the service area were estimated:

Depth zone (in feet)	Usable water in storage (in millions of acre-feet)
0 - 100	1.8
0 - 200	7.6
0 - 300	13.7
0 - 400	19.6
0 - 500	26.4
0 - 600	32.1
0 - 800	45.3
0 - 1,000	57.4

The continuation of overdraft pumping was postulated as occurring in other ground water basins throughout the area except where limited by court decree, voluntary action, or where serious damage to the basins would occur. However, this overdraft of ground water basins wherever postulated was not considered as adding to the safe local water supplies but as a temporary alternative to the taking of imported waters.

In estimating increases in the safe yield of local water supplies through construction of water conservation works, the following criteria were used in determining the probability of construction of future local development projects:

1. Estimated unit costs of the safe yield from the projects were compared to the estimated costs of imported water.
2. The estimated capital cost of constructing projects were compared with expected future financial capacity of local areas to construct projects.
3. Water rights and court decrees were considered.
4. Local attitudes towards financing of works were analyzed.

Other conditions that influenced the estimate of quantities of local water supplies available to meet consumptive requirements included considerations of water quality and salt balance. In certain areas, water quality considerations are overriding in determining the amounts of usable local water supplies. For example, in portions of the San Jacinto Valley of Riverside County, local ground water supplies which are available have such high mineral content that the supplies are not being utilized.

In the Whitewater-Coachella Service Area, the lack of hydrologic and geologic data precluded the formulation of estimates of local water supplies. In the absence of estimates of known quantities, it was assumed that urban entities would be able to extract about 12,000 acre-feet per year with the balance of the local water supplies assumed to be available for agriculture.

The estimated safe annual yield of present and projected local water supply development by decades for the period 1960 to 2020 is set forth in Table 4. Values for coastal Los Angeles County include the supply from the Los Angeles Aqueduct estimated at 320,000 acre-feet per annum. It should be noted that values tabulated herein do not include the quantities estimated to be over-drawn from ground water basins in the future.

TABLE 4

ESTIMATED SAFE YIELD OF LOCAL WATER SUPPLY DEVELOPMENT

(In thousands of acre-feet per annum)

Area	1960	1970	1980	1990	2000	2010	2020
San Luis Obispo Service Area[a]	88	94	128	147	174	187	189
Santa Barbara Service Area[a]	175	181	181	181	181	181	181
TOTALS	263	275	309	328	355	368	370
Southern California Coastal Plain and Coastal San Diego County Service Area							
Coastal Los Angeles County[b]	743	743	743	743	743	743	743
Orange County	154	154	154	154	154	154	154
Coastal Riverside County	135	135	135	135	135	135	135
Coastal San Bernardino County	135	135	135	135	135	135	135
Coastal San Diego County	111	111	111	111	111	111	111
TOTALS	1,278	1,278	1,278	1,278	1,278	1,278	1,278
Metropolitan Water District's Present Service Area[c]	1,029	1,029	1,029	1,029	1,029	1,029	1,029
Ventura County	149	179	205	205	205	205	205
Kern County Service Area	400	520	520	520	520	520	520
Antelope-Mojave Service Area	130	130	130	130	130	130	130
Whitewater-Coachella Service Area[d]	-	-	-	-	-	-	-

a. Does not include Cuyama Valley or Carrizo Plain areas.
b. Includes supply available from Los Angeles Aqueduct at 320,000 acre-feet per year.
c. These values also included in those areas containing this district.
d. Data not available.

Local Water Costs

Data were collected concerning costs of water in the southern California area for the purpose of comparing present water costs with expected costs of imported water. Present water costs to urban consumers in areas sampled range from a low of $35 per acre-foot to a high of $168 per acre-foot with the majority of water deliveries in the areas sampled having costs to the consumer of about $75 per acre-foot. In urban areas, distribution, meters and service, customer accounting, taxes, and general administration expenses are reflected in water costs averaging between $40 to $70 per acre-foot with production, treatment, and conveyance expenses costing consumers about $20 to $40 per acre-foot. Present water costs to agricultural consumers in sampled areas which receive water from surface distribution systems vary from $6 to $108 per acre-foot, with the majority of water deliveries in the areas sampled having consumer costs of about $25 per acre-foot.

These data are shown graphically on Figures 1 and 2, which depict the frequency of the magnitude of consumers costs for water by the amount of water delivered relative to the total deliveries of all agencies sampled. Tables 5 and 6 summarize the results of this water cost survey.

TABLE 5

LEVELS OF URBAN WATER COSTS AND QUANTITIES OF WATER DELIVERED BY SAMPLED WATER AGENCIES IN THE SOUTHERN CALIFORNIA AREA IN 1957

Levels of water cost, dollars per acre-foot	Annual water deliveries by sampled agencies as a function of cost		Per cent of total water delivered at cost, each level	Weighted average cost, by levels of water cost, in dollars per acre-foot
	Deliveries in acre-feet	Cost in dollars per acre-foot[a]		
$ 25	2,400	$ 35		
to	8,000	45	1.5	$ 44
50	1,000	50		
Subtotal	11,400			
	1,000	58		
	8,800	61		
	22,500	62		
51	444,000	65		
to	9,200	70	72.8	66.5
75	12,200	71		
	28,800	72		
	41,500	73		
	800	74		
Subtotal	568,800			
	21,000	78		
	10,500	79		
	3,200	80		
	4,400	80		
	9,400	80		
76	700	82	12.6	82
to	9,800	82		
100	2,700	83		
	23,900	83		
	5,400	87		
	1,000	96		
	5,700	98		
Subtotal	97,700			

LEVELS OF URBAN WATER COSTS AND QUANTITIES OF WATER
DELIVERED BY SAMPLED WATER AGENCIES IN THE
SOUTHERN CALIFORNIA AREA IN 1957
(continued)

Levels of water cost, dollars per acre-foot	Annual water deliveries by sampled agencies as a function of cost: Deliveries in acre-feet	Annual water deliveries by sampled agencies as a function of cost: Cost in dollars per acre-foot[a]	Per cent of total water delivered at cost, each level	Weighted average cost, by levels of water cost, in dollars per acre-foot
$101 to 125	8,300	$111	11.4	$118
	80,000	119		
Subtotal	88,300			
over 125	8,600	130	1.8	144
	5,000	168		
Subtotal	13,600			
TOTAL	779,800		100.0	

a. These costs include all charges to the consumer including cost of water, taxes, and assessments.

TABLE 6

LEVELS OF AGRICULTURAL WATER COSTS AND QUANTITIES OF WATER DELIVERED BY SAMPLED WATER AGENCIES IN THE SOUTHERN CALIFORNIA AREA IN 1957

Levels of water cost, dollars per acre-foot	Annual water deliveries by sampled agencies as a function of cost		Per cent of total water delivered at cost, each level	Weighted average cost, by levels of water cost, in dollars per acre-foot
	Deliveries in acre-feet	Cost in dollars per acre-foot[a]		
$ 0	3,600	$ 6		
to	7,400	9	29.3	$ 9.1
15	2,000	15		
Subtotal	13,000			
16	800	17		
to	12,200	22	40.2	22
30	4,900	23		
Subtotal	17,900			
31	800	31		
to	2,500	36	26.6	38.8
45	6,600	40		
	1,900	41		
Subtotal	11,800			
over	400	55	3.9	55
45	1,400	55		
Subtotal	1,800			
TOTAL	44,500		100.0	

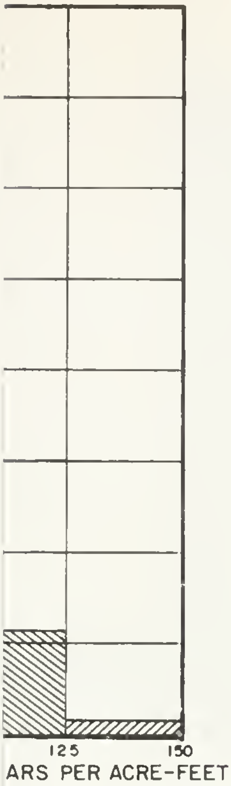
a. These costs include all charges to the consumer including cost of water, taxes and assessments.

In addition to these data on costs of water provided through surface distribution systems, a comprehensive analysis of the actual cost of pumped ground water with present day installation and energy costs was performed in the Kern County Service Area, and correlations of cost to plant use factors and pumping lift were prepared. These correlations were later employed in combination with estimates of usable water in storage and with the price of imported water to assess the portion of future water requirement, year by year, that would be met from draft on ground water and that which would constitute a demand for project water.

Average pumping costs were found to vary from a low of approximately $4.40 per acre-foot in the Buena Vista Water Storage District, where an average pumping lift of 90 feet is presently (1957) experienced and pumping is performed at a relatively low plant use factor of 19 per cent, to a high of approximately $10.20 per acre-foot in the Wheeler Ridge-Maricopa Water Storage District, where an average lift of slightly in excess of 400 feet and an average plant use factor of 57 per cent prevailed in 1956. Actual costs to individuals were, of course, either greater or less than these average costs. The plant use factor refers to the ratio of the actual hours of plant operation per year to the total hours in a year, expressed as a percentage. The unit pumping costs evaluated include the annual service charge on connected load, charge for electric energy consumed, interest and depreciation on the initial investment, taxes, maintenance, replacement, and the cost of periodic lowering of pumping bowls.

If present unit cost relationships are maintained, a continuation of the present overdraft, with its accompanying increase in pumping lifts, can only result in higher ground water pumping costs. It is apparent that

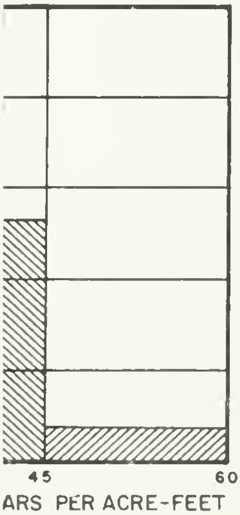
FIGURE 1



NOTE:
BASED ON A SAMPLE OF 28 AGENCIES DISTRIBUTING WATER TO URBAN CONSUMERS.

OF LEVELS OF WATER COSTS
N CONSUMERS

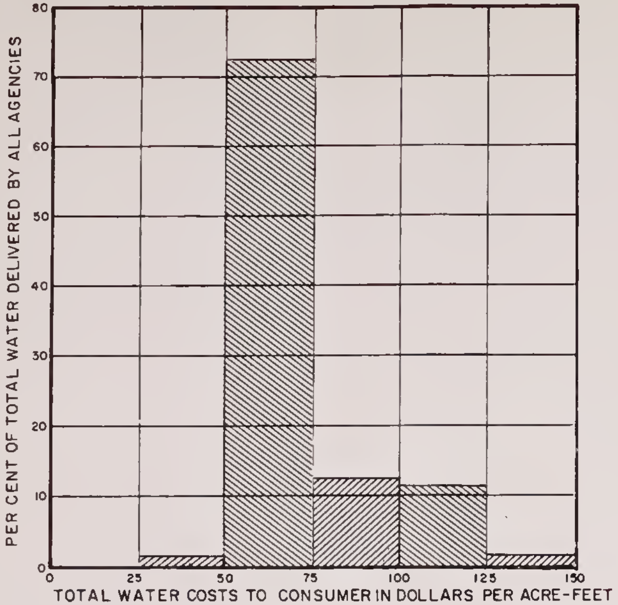
FIGURE 2



NOTE:
BASED ON A SAMPLE OF 12 AGENCIES DISTRIBUTING WATER TO AGRICULTURAL CONSUMERS.

OF LEVELS OF WATER COSTS
RAL CONSUMERS

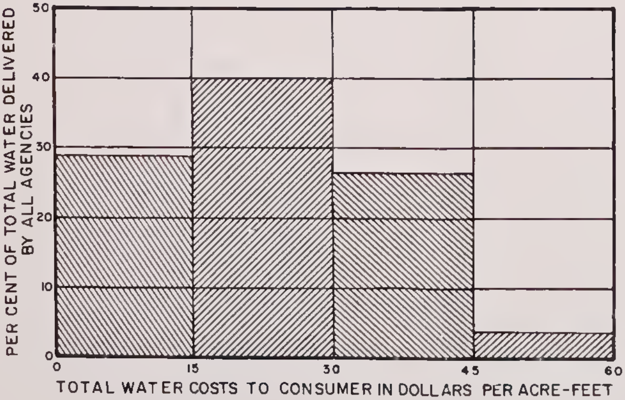
FIGURE 1



NOTE:
BASED ON A SAMPLE OF 28 AGENCIES DISTRIBUTING WATER TO URBAN CONSUMERS.

FREQUENCY OF DISTRIBUTION OF LEVELS OF WATER COSTS
TO URBAN CONSUMERS

FIGURE 2



NOTE:
BASED ON A SAMPLE OF 12 AGENCIES DISTRIBUTING WATER TO AGRICULTURAL CONSUMERS.

FREQUENCY OF DISTRIBUTION OF LEVELS OF WATER COSTS
TO AGRICULTURAL CONSUMERS

without the introduction of imported water some presently irrigated land would be forced out of production prior to year 2020, to some extent by actual exhaustion of underlying ground water supplies, but to a much larger degree as a result of rising pumping costs pushing total production costs to the point where insufficient incentive to farm would remain.

Other Possible Water Sources

Several other sources of water supply were considered as possible alternatives to importation of water from northern California or with respect to the effects of these sources on the rate of growth in demand for northern California water. These possible sources include the reclamation of water from sewage, the desalinization of drainage waters from the Imperial Valley, and the conversion of sea water to fresh water, and are discussed in the following paragraphs. As it will be noted, even though these sources are available, an alternative source of water supply that meets the criterion of practicability, and is of comparable magnitude and economically competitive with water imported from northern California, is not available to the southern California area. It was therefore concluded that in the foreseeable future the expected economic growth of this area is dependent upon the importation of necessary water supplies.

Reclamation of Water from Sewage. At the present time there are over 600,000 acre-feet of sewage being discharged to the ocean annually from the metropolitan areas of southern California. Over the past several years, the Department of Water Resources has made studies of the feasibility of reclaiming water for beneficial use from this source. These studies have

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Reclaimed water cannot be used directly for general water supply purposes. Potential markets or uses for reclaimed water would, therefore, be limited to certain industrial purposes, recharge of ground water aquifers, repulsion of sea water intrusion, and minor agricultural and recreational purposes. Separate distribution systems would be necessary, adding to the expense. Sewage from most of the inland area is already being effectively reclaimed through use for irrigation or disposal to ground water.

The recharging of ground water basins by spreading or injection offers the best possibility for use of reclaimed water. On a large scale, the amount of water that could be put to general use in this manner would be limited by infiltration rates of these lands, transmissibility of the aquifers, pumping patterns, and availability of sufficient ground water storage. Care must be exercised in utilizing ground water storage so as not to interfere with the storage capacity needed for conservation of local runoff. It is also important that there be no continuous recycling of reclaimed water. In order to avoid increases in mineral concentration to levels which would render the water unfit for use and create adverse salt balance conditions in the underground basins, the recharge would necessarily be limited to the coastal plain where only one re-use would occur.

Increasingly severe problems in the treatment of sewage are being caused by the expanding use of detergents. It is very costly to remove detergents sufficiently to prevent foaming in the effluent.

It should be noted that the total quantity of sewage discharge to the ocean is not all "wasted" since it serves a necessary beneficial purpose in disposing of unusable saline and toxic waste products from urban development.

It was concluded that with the establishment of a definite market and the demonstration that the reclaimed water is competitive in cost to other sources of water available at the time such reclamation is contemplated, this source of water supply might satisfy a small increment of the total water demand of a portion of the coastal segment of southern California. This increment of supply might also be important in the event there is a delay in the introduction of northern California water to the area. However, this reclaimed water, because of its limited magnitude and because of the problems inherent in its reclamation and utilization, cannot be considered as a substitute for importation of water from northern California.

Desalinization of Drainage Waters from Imperial Valley. An investigation was made of the possibility of reducing the salt content in waters entering the Salton Sea through the New and Alamo Rivers from Imperial Valley and transporting this water to the South Coastal Area. At the present time, the membrane demineralization process appears to be the least expensive method for reducing the mineral content of this water from 2,000 parts per million to roughly 500 parts per million. It should be noted that the mineral content of this water has increased in the last few years. The estimated cost of desalinization of the 1.2 million acre-feet of water annually available from this source would be about $140 per acre-foot. Amorization of the capital investment plus annual operation and maintenance charges for the facilities to transport the water from the edge of Salton Sea to Perris Reservoir in Riverside County would be approximately $45 per acre-foot, resulting in a total estimated unit cost in the order of $185 per acre-foot.

In addition to the direct costs involved, consideration must be given to possible adverse effects that might result to recreational areas now developing around the Salton Sea. Without inflow to the Sea from the New and Alamo Rivers, evaporation over a period of years would practically eliminate this body of water. Investments amounting to several millions of dollars have been made along the shores of Salton Sea and, with the demand for recreational areas in southern California, additional expenditures are to be expected in this area.

Conversion of Sea Water. A source of water for municipal and industrial uses which has received widespread publicity during recent years is the ocean. The desalinization of ocean water has been studied by the Department of Water Resources and by the Stanford Research Institute under contract with the Department as well as by the University of California, Office of Saline Water, United States Department of the Interior, and other research groups. Study has been made of all known methods of accomplishing this conversion.

Conversion on the scale which must be considered as an alternative supply to water from northern California has never been undertaken. The best estimates that can be made at this time of accomplishing such conversion and reducing the mineral content of sea water to a usable quality range from $160 per acre-foot to over $600 per acre-foot, depending on the method. These estimates postulate further technological advances in order to reduce the cost to the low value. In addition, substantial costs would be incurred in pumping and conveyance of this supply from sea level to points of use inland. Water from this source, on the basis of the best information available at this time, is not competitive in cost to other sources of additional water supply for southern California, nor is there any reason to expect that it will become competitive in cost in the foreseeable future.

CHAPTER III. URBAN DEVELOPMENT

Of particular importance in planning delivery of additional water to the southern California area is the probable location and magnitude of its future urban development. Estimates of this growth were based on projections of population and studies of probable future economic conditions in this area. Estimates of future population in each subunit of the area were based upon studies of birth and death rates, national interstate migration patterns, population density patterns, and economic development and employment trends. The nature and extent of economic and population growth and the related development and uses of land, water, and other natural resources in California will be affected both by future levels and patterns of the national population and economy and by the economic and geographic resources, conditions, and potentialities for growth in the State itself. Accordingly, the studies enumerated above were conducted for the nation as well as for the State in order that the best possible picture of future conditions influencing the size of California's future population could be obtained.

The population forecasts were made for the period from the present until year 2020. The estimates of economic development and employment projections were made for the period from the present until 1980. These latter estimates were employed to test the reasonableness of the statistical population projections for the relatively near future with respect to the probable level and nature of economic activity.

Prior to developing any estimates of the location, magnitude, and timing of any future events, it is necessary to delineate as far as feasible the conditions expected to exist at the time the future events will occur.

In order that this study may accurately reflect the best understanding of probable future conditions, the expected future economic, social, political, geographic, and demographic conditions were set down and analyzed with the aid of professional consultants and business leaders. The studies described hereafter were made within the framework of the following assumptions concerning anticipated conditions applicable, in general, to the median projections of population, economic development, and employment in the United States and California. For the high and low projections, certain of the assumptions were accordingly revised.

(1) There will be no devastating war.

(2) There will be no major political upheavals.

(3) There will be no substantial changes in military manpower requirements.

(4) There will be no substantial changes in the proportion of total national defense spending that occurs in any region of the nation.

(5) The number and type of services performed by local and federal governmental agencies will continue to expand.

(6) Widespread epidemics or serious social or physical calamities will not occur.

(7) Larger portions of family incomes will be spent for services and recreational activities.

(8) Formal education will become socially more important in an individual's development.

(9) There will be a continued long-term growth of economy of the same general trend experienced between 1910 and 1958.

(10) The long-term economic growth may include temporary recessions such as those experienced during the last ten years.

(11) There will be no deep and prolonged economic depressions.

(12) Water and fuel supplies will be adequate to meet the needs of the growing population.

(13) New types of products, processes, production methods, and occupational skills will continue to be developed.

Under the conditions indicated by the preceding general assumptions the following specific assumptions were made:

(1) Continuing increases of about 1.5 per cent per year will occur in average productivity per worker.

(2) There will be a continued rise in real income and its more nearly uniform distribution among the population.

(3) National policy will aim to keep unemployment at not more than four per cent of the labor force.

(4) Public services and recreational facilities will be provided as they become necessary.

(5) The rate of interstate migration and population mobility will continue to fluctuate with rises and declines in levels of activity and employment.

(6) Medical science will improve, resulting in the higher future survival rates shown in Table 81, Attachment No. 4.

(7) The growth of California's economy and population will continue to be closely linked with the development of the national economy and population.

(8) Increasingly larger proportions of the goods and services consumed in this area will be produced here.

(9) Manufacturing employment will tend to increase more rapidly in the present outskirts of metropolitan areas than within the core of such areas.

(10) The proportions of professional and technical workers with special skills will continue to increase.

(11) Policies of relatively easy financing for new housing and residential reconversions will be continued.

(12) Transportation time within the Los Angeles Metropolitan Area and between the cities of southern California will be reduced through improvement in freeway facilities and through construction of an efficient rapid transit system.

(13) Public services for groups of small municipalities will be performed by central agencies so as to provide more efficient service by elimination of duplication.

(14) Maintenance of current air pollution conditions or improvement in these conditions will occur with the result that this factor will not act to decrease in-migration.

(15) The pattern of land use in southern California counties will continue to change as the older metropolitan areas become more intensely urbanized and increased use is made of the large stretches of level land in rural-agricultural counties for commercial, industrial, military and residential expansion.

(16) Continued declines will occur in the number of hours per average work week as have occurred historically from 63 hours in 1880 to 42 hours per average work week in 1956.

(17) A gradually increasing amount of the total personal income will be derived from retirement pensions, social security payments and similar sources. While the dollar value of social security payments increased 7.7 times during the period 1950-1957, the rate of increase in these payments has decreased to a 30 per cent increase from 1956 to 1957.

(18) The proportion of the population in the urban and urbanized areas will continue to increase.

(19) Differentials in economic activity and income levels among the different geographical regions of the nation will continue to diminish.

Further specific assumptions were made where necessary in the application of the methodology of the population projections.

Investigation of Future Population Growth

Population projections based on detailed studies, including forecasts of natural increase and net migration, generally are considered more reliable than those obtained by other methods. Accordingly, the future population figures presented here were developed by the usual procedure for making natural increase and net migration projections.

As in other areas of the United States, the rates of population and economic growth in California and the southern California area have been, and are expected to continue to be, related to and influenced both by the growth rate of the national population and economy and by local conditions and development within the State and the southern California area. Hence, projections of the populations of the Nation and State were prerequisites for projections of the southern California area population.

Because of uncertainties concerning future conditions and their effects on population growth, a series of projections was developed to show probable high, median and low populations of the United States, California and the southern California area.

For the high projections, it was assumed that future conditions will be the most favorable to population growth likely to be realized under the general assumptions stated before; for the low projections, future conditions will be the most unfavorable to population increase expected to occur. For the median projections, it was assumed that the effects of future conditions on population growth will be about midway between those assumed for the high and low projections.

It was judged more likely that the composite effect of future conditions on population growth probably will be closer to that indicated by the median projections than by either the high or low projections. Therefore, the median population projections were used in determining the urban water requirements on which the subsequent aqueduct design studies were based.

Procedure: The statistical procedure in developing the population projections is summarized as follows:

(1) United States and California fertility rates analyzed and projected to year 2020 at high, median, and low levels.

(2) United States and California mortality rates analyzed and projected to year 2020 at a median level.

(3) High, median, and low levels of United States population computed to year 2020 using projected fertility and mortality rates and expected immigration rates (cohort-survival projection).

(4) California net in-migration analyzed and projected to year 2020 at high, median, and low levels.

(5) High, median, and low levels of California population computed to year 2020, using projected fertility, mortality, and net in-migration rates.

(6) California's interregional pattern of population distribution analyzed and projected at high, median, and low levels to year 2020.

(7) Southern California counties' population pattern analyzed and projected at median levels by counties to year 2020.

(8) Median level of population projected for study areas of counties and subunits thereof to year 2020.

(9) United States economic development and employment by major categories estimated to year 1980.

(10) California employment by major categories estimated to year 1980.

(11) Southern California area employment by major categories projected to year 1980.

This procedure is based on the postulate that population projections may be developed logically from assumptions of future conditions, forces, and trends judged likely to be realized and analyses of probable effects of these assumptions on population and economic growth.

Components of Natural Increase

The basic elements in the population projection procedure, births and deaths, were analyzed by converting numerical changes into rates of change. These fertility and mortality rates, which combine to produce the population's natural increase rate, were analyzed and projected as reported in the following paragraphs for the nation and California.

Fertility Rates. A wide variation has been experienced in fertility rates over the last 50 years, with the trends, however, being relatively consistent and rates of change from year to year reasonably small. By analyzing fertility rates over the historical period, it was noted that changes occurred in the social and economic patterns of life that could be correlated with the fertility rate changes. These include changing economic conditions; increasing urbanization of the total population; increasing unit densities in large metropolitan areas; changes in religious, moral, and social outlooks on family size, and the measures necessary to control this size; changes in educational standards; and changes in infant mortality rates. Many of these social and economic patterns of life are interrelated and changes in any one of them are reflected in corresponding changes in others. Accordingly, an analysis of separate factors affecting the changes in fertility rates could not be done, but the over-all effect of all of these conditions was studied.

The primary historical effects of these patterns on fertility rates are stated in the following paragraphs:

(1) Effect of General Economic Conditions - Comparisons of historical data on fertility with indicators of economic activity, such as the gross national product, show that the trend in fertility rates follows the trend in economic activity. Many of the other factors are also influenced by general economic conditions in that the farm-city migration is speeded up during periods of high economic activity and retarded during periods of lowered activity. The net effect of all of the various ramifications of an increasing standard of living is that the national fertility rate will increase if it has been depressed or will be maintained at a high level unless influenced by other factors.

(2) Effect of Social Conditions - Family size, and the accompanying fertility rate, are conditioned by the over-all social outlook upon size of family. In our country, we have witnessed a large swing in the general outlook upon size of family, varying from the general opinion of over 50 years ago that large families are desirable, to the viewpoint which gained strength in 1920 through 1940 that family size should be at a minimum. Changes have been noted in this recent attitude in that larger family sizes are again becoming socially desirable.

Working in conjunction with the over-all social outlook on family size is the effect of increasing population densities thereon. Under the assumed future conditions of continuing an increase in the historical trend toward urbanization throughout the nation, constantly increasing population densities will occur in almost every metropolitan area in the country.

In comparing historical data on average household size between the total United States and the New York-New Jersey metropolitan area, there are strong indications that the average family size decreases as urban areas become more densely populated. This may be accounted for in part by the movement of young individuals to these very dense urban areas, thereby establishing one and two person households. A more crucial factor, however, is apparently the observed condition that in densely populated areas the natural increase rate is lower than in areas with less congested living conditions. Throughout the last 50 years, for example, the natural increase rates of the New York-New Jersey metropolitan region consistently have been about 20 per cent lower than natural increase rates for the total United States throughout all the ups and downs in the national rates.* This has occurred even though the proportion of women in the childbearing ages (20-44) is greater in the New York metropolitan area than in the nation. It should be noted that there may be other circumstances peculiar to this area which would limit the applicability of these data.

(3) Effect of Infant Mortality Rates - Throughout the last century, this nation's birth and infant mortality rates were both high, with the large number of births being necessary to compensate for the high infant death rate. Even into the early years of this century, one out of every ten children died during their first year after birth. Since 1915, however, this high rate of infant deaths has been steadily declining, with a leveling out in the rate of decline now being evident at a rate of 26 deaths per 1,000 births. Thus, lower fertility rates at this time will produce the family size which required substantially higher fertility rates 50 years ago. Between 1915 and 1930, a time of general prosperity and an expanding economy, the nation's infant mortality rate declined over 35 per cent. During the same time interval, the national crude birth rate, or number of births per 1,000 persons in the total population, declined 30 per cent. This decline in the birth rate during prosperous times may have been largely influenced by the corresponding decline in infant mortality rates. On the basis of expected improvements in medical science, a further decline in the infant mortality rate can be projected for the future. The influence of such a trend may be to lower birth rates, for fewer births would be required to achieve the desired family size.

In item No. 1 of the preceding discussion it was concluded that, under conditions of an expanding economy, fertility rates would be maintained at a high level as might be defined by other factors. The rapid rise in fertility rates during the period from 1940 to recent years cannot be completely attributed to the rapid expansion of the nation's economy during the same period. During this time, many young individuals have experienced an increasing freedom from the burden of care of parents, due to the expansion of the social security program, pensions, and retirement programs. Accordingly, these young persons were enabled to support larger families of their own. The effect of this on fertility rates, however, will probably be short-lived and, after new customs regarding this financial support of parents become universal, fertility rates will either stabilize or decline. In projecting national fertility rates, therefore, even though the country's economy is expected to continue its historic expansion, an assessment of the other factors, when combined with the economic outlook, indicates a long-term downward trend in fertility rates.

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*Source: "People, Jobs and Land 1955-1975", Regional Plan Association Bulletin No. 87, June, 1957.

The levels of fertility expected through the study period were estimated through projection of the gross reproduction rate. This rate is a good measure of the propensity for women in the childbearing ages to have children. The gross reproduction rate represents the number of daughters a hypothetical cohort of 1,000 women entering the childbearing period would have during their lives, if they were subject to a given set of age-specific birth rates*, and if none of the cohort were to die before the childbearing period was completed. However, the direct application of this gross reproduction rate to the total number of women in the childbearing ages, 15 to 44 years old, might result in an erroneous estimate of births. This is due to the interaction of two factors: (1) age-specific rates vary widely

*The age-specific birth rate represents the number of children born annually per 1,000 women in the specific age group concerned. In this study, age-specific birth rates were used by successive five-year-age groups for women between the ages of 15 and 44 years old.

among the six 5-year-age groups representing women 15 to 44 years old and (2) the number of women in any particular 5-year-age group also varies widely from one 5-year period to the next. Application of 5-year-age-specific birth rates to the irregular age distribution of producing women results in a more accurate estimate of the number of births due to a given general level of fertility than would result from the direct use of the gross reproduction rate. Thus, while projections were made of the gross reproduction rates, age-specific birth rates were derived therefrom and used in the population aging process to calculate the number of births.

Low, high, and median projections of the national gross reproduction rate were made as follows, covering the expected range in fertility levels:

(1) Low Series - The low series gross reproduction rate was projected by first determining the rate required to maintain the population at a constant size under the projected mortality rates at the end of the period, and then projecting a decline from the present levels to that low level at a rate of decline equivalent to that experienced in the period 1920 to 1930.

(2) High Series - The high series rate was based on a continuation of the high rates experienced in the period 1955-57 until 1970. From 1970 to 2020, a rate of decline equal to the projected decline in the median rate in this period was projected for the high series.

(3) Median Series - It was assumed that the 1950-51 rate was representative of a probable median rate under the median assumptions to about 1975. The rate for this period, which is lower than current rates, was selected as reasonable because: (1) continuing increase congestion in urban areas will tend to change the current favorable social outlook on large families; (2) the current rates are higher than any previously recorded in this century. Projections from this point may be either up, constant, or down. Due to the extremely high current level, the law of probability favors a downward trend; and (3) infant mortality trends favor a declining gross reproduction rate. As the gross reproduction rate is now

> above this level, the rate was projected as declining to this level by 1975. The median rate at the end of the study period was assumed to be slightly higher than that rate which would maintain the population at a constant size under the mortality conditions projected. The rate of decline in the median rate for the period 1975 to 2020 was projected at the 1958 to 1975 rate of decline until this final rate was achieved.

The national historical and projected levels of the gross reproduction rate are presented on Table 7 and shown graphically on Figure 3.

TABLE 7

HISTORICAL AND PROJECTED NATIONAL GROSS REPRODUCTION RATE

(Annual average for five-year periods)

Historical		Projections of gross reproduction rates			
Period	Gross reproduction rates	Period	Low	Median	High
1905-09	1,793.0	1955-59	1,700	1,750	1,790
1910-14	-[a]	1960-64	1,600	1,700	1,790
1915-19	-[a]	1965-69	1,500	1,640	1,790
1920-24	1,578.9	1970-74	1,400	1,605	1,765
1925-29	1,401.2	1975-79	1,300	1,570	1,715
1930-34	1,108.0	1980-84	1,200	1,515	1,665
1935-39	1,101.0	1985-89	1,200	1,465	1,615
1940-44	1,227.6	1990-94	1,200	1,410	1,565
1945-49	1,452.8	1995-99	1,200	1,360	1,515
1950-54	1,623.8	2000-04	1,200	1,305	1,465
		2005-09	1,200	1,250	1,415
		2010-14	1,200	1,240	1,365
		2015-19	1,200	1,240	1,315

a. Data unavailable.

Excellent data on age-specific birth rates and gross reproduction rates were available for the period 1940 to 1956, which data were used in deriving correlations between these two indicators of births. During this period of time, the gross reproduction rate fluctuated over the entire range of values covered in the forecast rates, as shown on Figure 3. The historical and median projection of these data for the United States are tabulated on Table 8, and the correlation thereof is demonstrated graphically on Figure 4.

TABLE 8

HISTORICAL AND PROJECTED NATIONAL GROSS REPRODUCTION RATES AND AGE-SPECIFIC BIRTH RATES

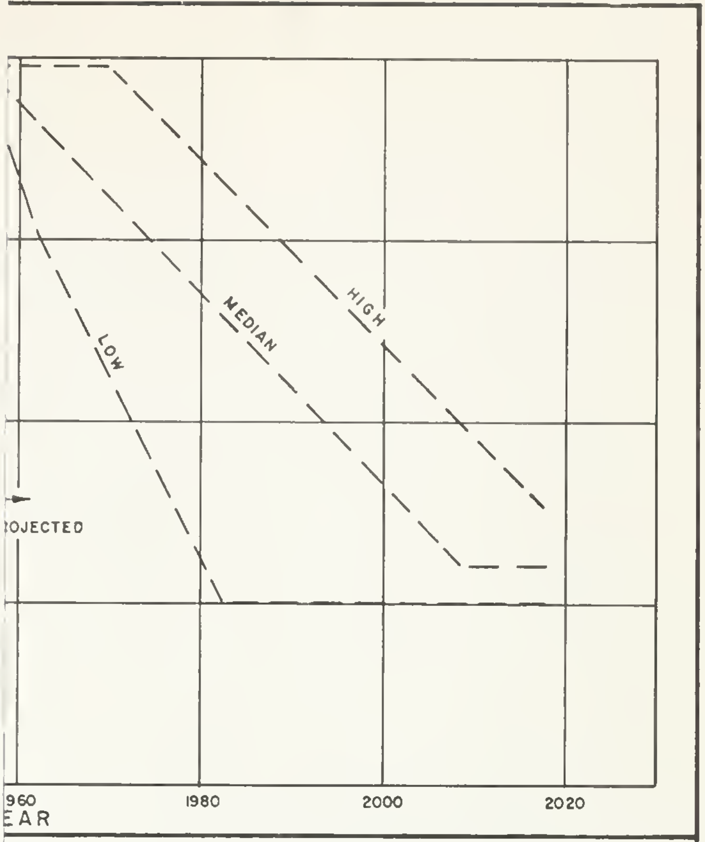
Year	Gross reproduction rates	Age-specific birth rates by five-year age groups					
		15-19	20-24	25-29	30-34	35-39	40-44
		Historical, by years					
1940	1,121	54.1	135.6	122.8	83.4	46.3	15.6
1941	1,168	56.9	145.4	128.7	85.3	46.1	15.0
1942	1,277	61.1	165.1	142.7	91.8	47.9	14.7
1943	1,323	61.7	164.0	147.8	99.5	52.8	15.7
1944	1,249	54.3	151.8	136.5	98.1	54.6	16.1
1945	1,212	51.1	138.8	132.2	100.2	56.9	16.6
1946	1,430	59.3	181.8	161.2	108.9	58.7	16.5
1947	1,593	79.3	209.7	176.0	111.9	58.9	16.6
1948	1,514	81.8	200.3	163.4	103.7	54.5	15.7
1949	1,515	83.4	200.1	165.4	102.1	53.5	15.3
1950	1,505	81.6	196.6	166.1	103.7	52.9	15.1
1951	1,591	86.9	212.0	174.2	108.3	54.1	15.3
1952	1,635	85.4	218.1	180.4	113.1	56.1	15.3
1953	1,665	87.5	224.5	183.8	113.0	57.3	15.5
1954	1,723	89.8	235.6	188.5	116.4	58.8	15.8
1955	1,741	89.7	240.4	190.8	115.8	59.5	15.7
1956	1,793	94.2	251.3	195.5	116.4	60.3	15.9
		Median projection, five-year annual averages					
1955-59	1,750	93.3	242.0	194.2	118.0	59.9	15.8
1960-64	1,700	89.2	233.0	188.2	115.2	58.0	15.8
1965-69	1,640	85.0	222.2	181.2	112.0	56.8	15.8
1970-74	1,605	82.4	216.0	177.0	110.0	56.0	15.7
1975-79	1,570	80.0	211.0	173.2	108.4	55.0	15.7
1980-84	1,515	76.0	200.6	167.0	105.8	53.8	15.7
1985-89	1,465	72.6	192.0	161.0	103.2	52.6	15.7
1990-94	1,410	69.0	182.6	155.0	100.8	51.6	15.7
1995-99	1,360	66.0	174.2	149.8	98.6	50.8	15.6
2000-04	1,305	62.4	165.0	143.6	96.2	50.0	15.6
2005-09	1,250	59.2	156.8	137.8	94.0	49.0	15.6
2010-14	1,240	58.8	155.0	136.8	93.8	49.0	15.6
2015-19	1,240	58.8	155.0	136.8	93.8	49.0	15.6

California's fertility rates were forecast by extrapolating the historical ratio of California's gross reproduction rate to the nation's rate toward unity in the year 2020. This projected ratio was applied to the projected series of gross reproduction rates for the United States to derive the projected high, median, and low gross reproduction rates for California.

As for the United States, the actual number of births during each five-year span through the study period was computed through a correlation of the gross reproduction rate with specific birth rates by 5-year-age groups of women. Comparison of the idealized correlation curves, Figure 4, used in the United States projection, with historical California rates indicated that these curves could be used to derive California age-specific birth rates from the forecast gross reproduction rates. The historical and projected ratios between California and the United States gross reproduction rates, and the corresponding projected California gross reproduction rates are presented in Attachment No. 5, Table No. 80. The age-specific birth rates for California are presented in Attachment No. 5, Table No. 81.

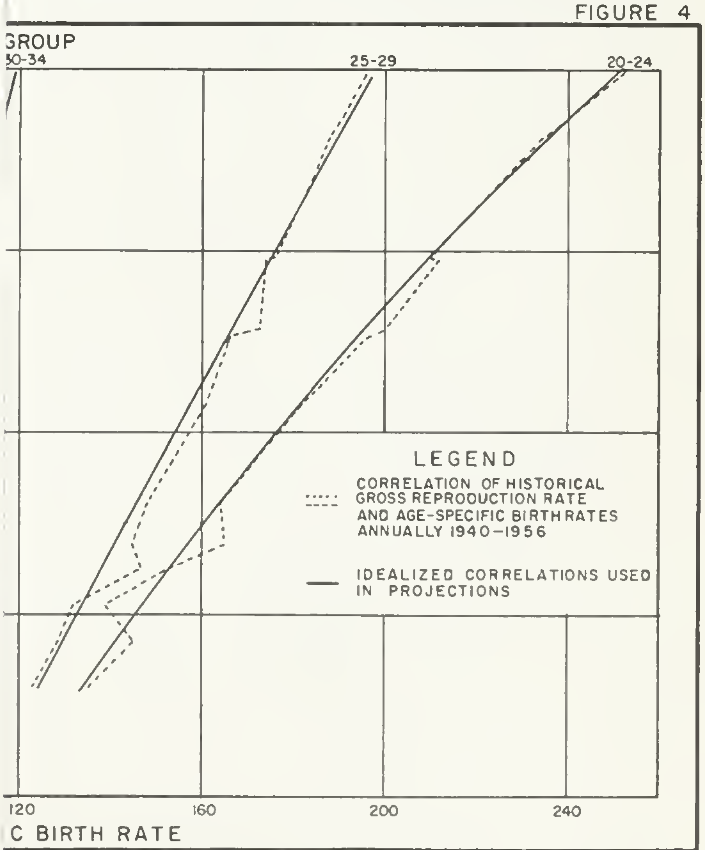
The national and California crude birth rates, which result from the median projection of age-specific birth rates, are tabulated following. It was observed that these crude rates exhibited peaks occurring at 25-year intervals. The peaks are due to the influence of the large proportions of childbearing women appearing in the population 25 years after the high fertility rates experienced in the decade 1947-1957. The dips are due to the age and sex group proportions resulting from the low fertility rates experienced in the decade 1930-1940. It can be noted that the fluctuations in these rates are not present in the projected gross reproduction rates.

FIGURE 3



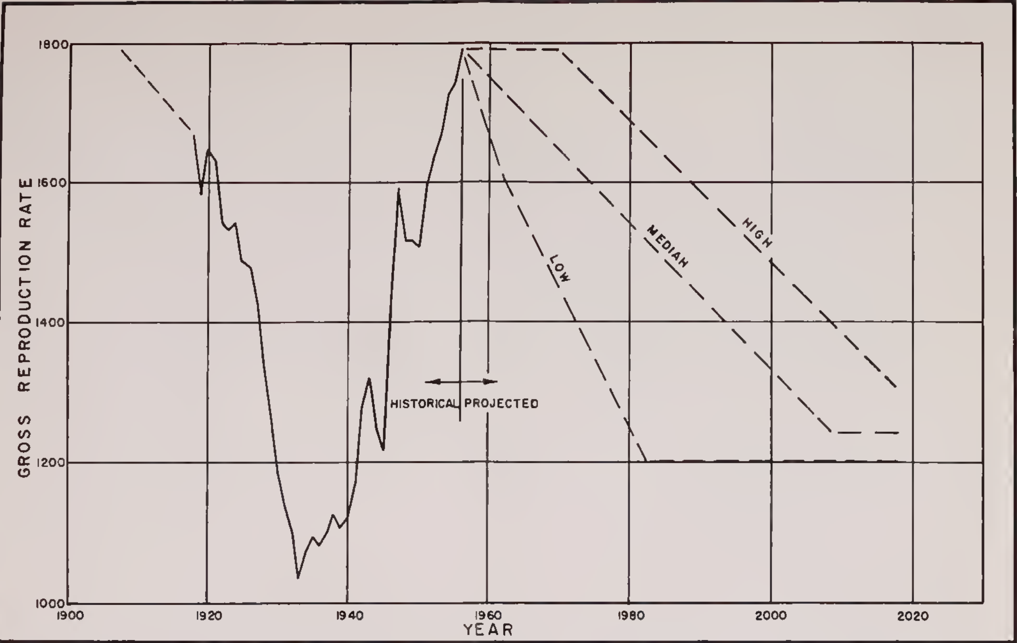
EPRODUCTION RATE IN THE UNITED STATES

FIGURE 4



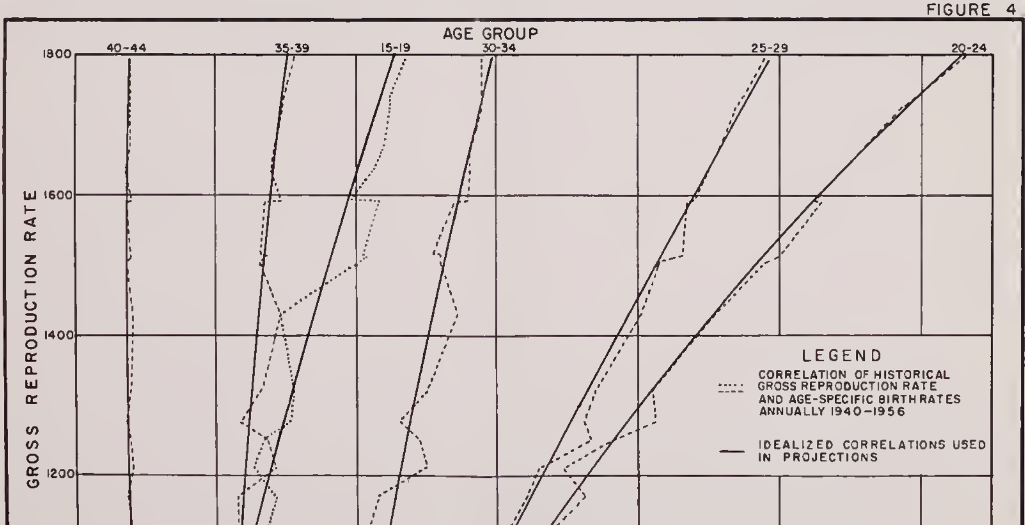
ELATION OF AGE- SPECIFIC BIRTH RATES
N RATE IN THE UNITED STATES

FIGURE 3



HISTORICAL AND PROJECTED GROSS REPRODUCTION RATE IN THE UNITED STATES

FIGURE 4



HISTORICAL AND PROJECTED CORRELATION OF AGE-SPECIFIC BIRTH RATES AND GROSS REPRODUCTION RATE IN THE UNITED STATES

Thus, smooth projections of the basic components of change will result in varying rates of population growth as represented by the crude birth rate.

	Historical and median future crude birth rates, average per decade		
Decade	United States	California	Ratio of California to United States
1940-50	22.6	22.1	0.978
1950-58	24.7	24.0	0.972
1950-60	24.5	23.8	0.971
1960-70	22.8	23.0	1.009
1970-80	23.8	23.2	0.975
1980-90	22.6	22.1	0.978
1990-2000	21.2	20.9	0.986
2000-10	19.9	19.6	0.985
2010-20	19.0	18.9	0.995

Mortality Rates. The mortality rates used in this study were adopted from rates of nonsurvival used by the Bureau of the Census that were projected to the year 2000 by the Division of the Actuary of the Social Security Administration. In the past, trends in the nation's mortality rates have been fairly consistent, varying only slightly from a uniformly declining curve. Forecasts of mortality rates thus exhibit a very narrow range between expected highs and lows. Accordingly, the same series of mortality rates was used for each of the high, median, and low projections.

The series of mortality rates used here is the medium series used in projections by the Population Division of the Bureau of the Census, but converted from nonsurvival rates as obtained from the Census Bureau into the form of survival rates. The survival rate represents the number of persons in a particular cohort, or 5-year-age group, surviving through a given five-year time period. It is applied to the total number of persons in the cohort at the beginning of that five-year period.

Thus, smooth projections of the basic components of change will result in varying rates of population growth as represented by the crude birth rate.

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The projection of nonsurvival rates by the Social Security Administration was made on the basis of expected improvements through the next forty years in medical science. This was done by setting down for each age-sex group the expected percentage decline in mortality between 1955 and 2000 for the four major cause-of-death groups, converting these percentages of decline into actual mortality rates in the year 2000, and then interpolating between current mortality and these 2000 rates for each intervening period. These assumed improvements in medical science appear to be consistent with the general assumptions made in this report and so the projected rates were adopted intact. Extrapolations were made from these projections for the period 2000 to 2020. The United States survival rates used in the projections are presented in Attachment No. 5, Table No. 82.

California's mortality rates were related to the national rates by extrapolating the historical ratio between the California and the United States crude death rates (number of deaths annually per 1,000 population), and applying the forecasted ratio to the projected national survival rates. The historical and projected United States and California crude death rates and ratios thereof are as follows:

	Historical and projected crude death rates, average per decade		
Decade	United States	California	Ratio California to United States
1940-50	10.1	10.4	1.030
1950-58	9.4	8.9	.947
1950-60	9.4	8.9	.943
1960-70	8.9	8.7	.977
1970-80	8.5	8.4	.993
1980-90	8.2	8.2	.999
1990-2000	8.1	8.1	1.000
2000-10	8.0	8.0	1.000
2010-20	8.0	8.0	1.000

The California survival rates are presented in Attachment No. 5, Table No. 83. These rates combine the separate forecasts of national male and female survival rates for simplicity in application.

United States Population Projection

High, median, and low population projections were calculated for the United States using the cohort-survival method of demographic analysis, which essentially consists of a step by step growth of the existing population. For a large, confined area such as the continental United States, from which emigration has been relatively small and foreign born immigration is now closely controlled, the cohort-survival method is considered to be the most accurate means of projection, since it takes into account the vital statistics in their most extensive detail. Fertility and mortality rates were used as previously defined, projections of immigration were developed, the population aged as shown in sample computations, and resultant projections were developed.

Immigration. It was assumed that, for the next sixty years, net migration will continue to be positive, or into the United States. It was further assumed that annual foreign born immigration quotas will be closely controlled by the Federal Government and will be at approximately the same levels as during the past ten to fifteen years. The assumed net immigration levels were based on projections made by the United States Bureau of the Census in "Current Population Reports", Series P-25, No. 123, page 4, to the year 1975. Immigration levels for the remainder of the study period were extrapolated on the basis of these projections. The assumed levels of immigration are:

Median and High Series Projections

1955 to 1960 total net immigration 1.4 million

1960 to 2020 net immigration 1.2 million during
each five-year period

Low Series Projection

1955 to 1960 total net immigration 1.4 million

1960 to 2020 net immigration 1.0 million during
each five-year period

The age-sex distribution of projected net immigration was based on the distributions experienced in the past several years. The historical data used as a base were taken from "Current Population Reports", Series P-25, No. 43. The historical distribution is for the years 1946 to 1948 and undoubtedly reflects the influx of war brides during that period. This distribution was adjusted slightly by lowering the percentage of net immigrants in the female age group, 20 to 24 and 25 to 29, to minimize the effect of these war brides on the age distribution of females.

It was assumed that immigration occurs at a uniform rate; hence the survival rate for a five-year period could not be applied to the entire group of immigrants for that five-year period. In the interest of simplified computation, the five-year survival rate for each age group was applied to six-tenths of the total immigrants in that age group for that period and no survival rate was applied to the remaining four-tenths of the immigrants.

The projected United States net immigration levels and age-sex distribution of immigrants are presented in Table 9.

TABLE 9

PROJECTED UNITED STATES NET IMMIGRATION BY AGE AND SEX

(In thousands of persons per five-year period)

Age group at date of entry	Net male immigration				Net female immigration			
	Per cent of total immigration*	1955 to 1960	Median and high: 1960 to 2020	Low 1960 to 2020	Per cent of total immigration*	1955 to 1960	Median and high: 1960 to 2020	Low 1960 to 2020
0- 4	2.2	30.8	26.4	22.0	2.1	29.4	25.2	21.0
5- 9	1.5	21.0	18.0	15.0	1.5	21.0	18.0	15.0
10-14	1.5	21.0	18.0	15.0	2.1	29.4	25.2	21.0
15-19	2.7	37.8	32.4	27.0	5.3	74.2	63.6	53.0
20-24	4.8	67.2	57.6	48.0	8.7	121.8	104.4	87.0
25-29	5.6	78.4	67.2	56.0	7.1	99.4	85.2	71.0
30-34	5.0	70.0	60.0	50.0	5.1	71.4	61.2	51.0
35-39	5.1	71.4	61.2	51.0	4.4	61.6	52.8	44.0
40-44	4.8	67.2	57.6	48.0	3.9	54.6	46.8	39.0
45-49	4.1	57.4	49.2	41.0	3.4	47.6	40.8	34.0
50-54	3.0	42.0	36.0	30.0	2.8	39.2	33.6	28.0
55-59	2.2	30.8	26.4	22.0	2.2	30.8	26.4	22.0
60-64	1.6	22.4	19.2	16.0	1.8	25.2	21.6	18.0
65-69	1.2	16.8	14.4	12.0	1.5	21.0	18.0	15.0
70-74	0.7	9.8	8.4	7.0	1.0	14.0	12.0	10.0
75-79	0.3	4.2	3.6	3.0	0.5	7.0	6.0	5.0
80-84	0.1	1.4	1.2	1.0	0.2	2.8	2.4	2.0
85+	---				---			
All ages	46.4	649.6	556.8	464.0	53.6	750.4	643.2	536.0
Total male and female	100.0%	1,400,000	1,200,000	1,000,000				

*Based on records of immigration into the United States between July 1, 1946 and June 30, 1948, from "Current Population Reports" Series P-25 No. 43, a publication of the U. S. Bureau of the Census.

Computation of United States Population Projection. In this study, the growth rates were applied to five-year-age groups by sex. The base population was taken from the Bureau of the Census, "Current Population Reports", Series P-25, No. 146, Table 1, page 7, which tabulated the total United States population, including armed forces overseas as distributed by age and sex, estimated as of July 1, 1955.

Each five-year-age group was aged by applying its particular survival rate according to age and sex through each successive five-year period from 1955 to 2020. The same survival rate was applied to six-tenths of the immigrants in that group for that period. The survivors in this group, plus four-tenths of the immigrants in the next oldest age group, would comprise the next oldest age group in the base population for the next five-year period. For example, in the median series projection, the male (10-14) age group of the 1960 population was aged by five years and became the (15-19) age group in the 1965 population as follows:

1960 male (10-14) base group	8,761,949
0.6 x 1960 to 1965 male (10-14) immigrants	10,800
	8,772,749
Multiply by 1960 to 1965 (10-14) to (15-19) survival factor	x 0.99551
	8,733,359
Add 0.4 x 1960 to 1965 male (15-19) immigrants	x 12,960
Result is 1965 male (15-19) group	8,746,319*

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*The use of this number of digits does not imply this expected accuracy in the projection but was only adopted to maintain the accuracy of the method.

Applying this method to each five-year-age group, male and female in the 5 through 85 plus age groups, results in a projected population at the following five-year point.

The size of the 0-4 age group for a particular five-year point in time was projected by determining the survivors of births during the previous five-year period. First, the average gross reproduction rate during the five-year period was estimated from the projected gross reproduction rate curves on Figure 3. The five-year-age group annual specific birth rates corresponding to this average gross reproduction rate were then taken from the curves shown on Figure 4. These annual age-specific birth rates were multiplied by five years and applied to the average number of women for that period in the (15-19) through (40-44) age groups by respective individual group. These computations and resulting numbers of births are tabulated in Attachment No. 6, Table No. 84.

The total births during the five-year period, determined by summing births in the individual groups, was distributed by sex in the ratio of 1,055 males to 1,000 females as summarized in Table No. 84. The (0-4) survival rates by sex were then applied to these births to determine the survivors in the (0-4) age group at the end of the period. The error involved in applying five-year average mortality rates to birth occurring the latter part of the period was considered negligible since the largest number of deaths in the (0-4) group occurs from age 0 to 1.

Projected United States Population. The high, low, and median projections of population resulting from the application of the cohort-survival method of forecasting is shown in Table 10, together with the numerical size of the components of change. Table 11 and Figure 5 show the forecasted high, median, and low national population, together with historical data from 1900. The step-by-step median projection of the United States population by age and sex groups is tabulated in Attachment No. 6, Tables 85 through 87.

The median projection closely approximates the tentative national projection furnished by the United States Department of Commerce, Office of Business Economics, to the United States Army Corps of Engineers, Philadelphia District, which is as follows:

Year	National population (millions)
1965	195
1980	248
2010	370

This projection is subject to revision up to the date of publication of the Corps of Engineers studies, which is scheduled for December, 1959.

The Bureau of the Census recently published a series of national population projections to 1980 in "Current Population Reports", P-25, No. 187, and the high, median, and low projections contained herein are in agreement with the series II, III, and IV projections of the Census Bureau, respectively.

TABLE 10

HISTORICAL AND PROJECTED COMPONENTS OF CHANGES IN THE UNITED STATES POPULATION

(Values in thousands)

Year	Population	Total change during decade	Natural increase: Births	Natural increase: Deaths	Immigration
		Historical Components[a]			
1940	131,788				
		19,344	31,913	14,366	1,797
1950	151,132				
		Low Projection of Components[b]			
1950	151,683				
		28,017	39,820	14,833	3,030
1960	179,700				
		25,600	40,800	17,200	2,000
1970	205,300				
		27,700	45,000	19,300	2,000
1980	233,000				
		27,000	46,500	21,500	2,000
1990	260,000				
		27,900	50,400	24,500	2,000
2000	287,900				
		28,400	53,800	27,400	2,000
2010	316,300				
		28,800	57,200	30,400	2,000
2020	345,100				
		High Projection of Components			
1950	151,683				
		29,217	41,087	14,900	3,030
1960	180,900				
		33,000	48,000	17,400	2,400
1970	213,900				
		43,200	60,500	19,700	2,400
1980	257,100				
		50,200	70,000	22,200	2,400
1990	307,300				
		56,900	79,900	25,400	2,400
2000	364,200				
		62,800	89,300	28,900	2,400
2010	427,000				
		65,800	96,100	32,700	2,400
2020	492,800				

HISTORICAL AND PROJECTED COMPONENTS OF CHANGES IN THE UNITED STATES POPULATION (continued)

(Values in thousands)

Year	Population	Total change during decade	Natural increase		Immigration
			Births	Deaths	
Median Projection of Components[b]					
1950	151,683				
		28,717	40,547	14,860	3,030
1960	180,400				
		29,400	44,300	17,300	2,400
1970	209,800				
		37,200	54,300	19,500	2,400
1980	247,000				
		40,900	60,500	22,000	2,400
1990	287,900				
		42,900	65,500	25,000	2,400
2000	330,800				
		44,400	70,200	28,200	2,400
2010	375,200				
		46,600	75,900	31,700	2,400
2020	421,800				

---

a. Historical population enumerated as of April 1 (total population of continental United States, including armed forces overseas). Source: United States Bureau of the Census publications.

b. Projected population as of July 1. Projected population and components of change are from the cohort-survival projection (Tables 83, 85, and 86). While values are rounded to this significance for illustrative purposes, this does not imply an expected level of accuracy in the projection. The 1950 to 1960 components are based on 1950 to 1958 estimated annual components of change from the United States Bureau of the Census, "Current Population Reports", Series P-25, No. 173.

TABLE 11

HISTORICAL AND PROJECTED POPULATION OF THE UNITED STATES AND CALIFORNIA

Year	United States population[a]	California population[b]	California population in per cent of United States population
	Historical Population[c]		
1900	75,994,575	1,485,053	1.95
1910	91,972,266	2,377,549	2.59
1920	105,710,620	3,426,861	3.24
1930	122,775,046	5,677,251	4.62
1940	131,669,275	6,907,387	5.25
1950	151,132,000	10,586,223	7.00
1958	173,435,000	14,612,000	8.43
	Projected Population[d]		
1960	L 179,700,000	15,650,000	8.71
	M 180,400,000	15,830,000	8.77
	H 180,900,000	15,980,000	8.83
1970	L 205,300,000	20,950,000	10.20
	M 209,800,000	21,700,000	10.34
	H 213,900,000	22,400,000	10.47
1980	L 233,000,000	26,300,000	11.29
	M 247,000,000	28,200,000	11.42
	H 257,100,000	30,000,000	11.67
1990	L 260,000,000	31,200,000	12.00
	M 287,900,000	35,000,000	12.16
	H 307,300,000	38,500,000	12.53
2000	L 287,900,000	36,000,000	12.50
	M 330,800,000	42,100,000	12.73
	H 364,200,000	47,800,000	13.12
2010	L 316,300,000	40,300,000	12.74
	M 375,200,000	49,000,000	13.06
	H 427,000,000	57,800,000	13.54

HISTORICAL AND PROJECTED POPULATION
OF THE UNITED STATES AND CALIFORNIA
(continued)

Year	United States population[a]	California population[b]	California population in per cent of United States population
	Projected Population[d] (cont.)		
2020	L 345,100,000	44,000,000	12.75
	M 421,800,000	55,800,000	13.23
	H 492,800,000	68,000,000	13.80

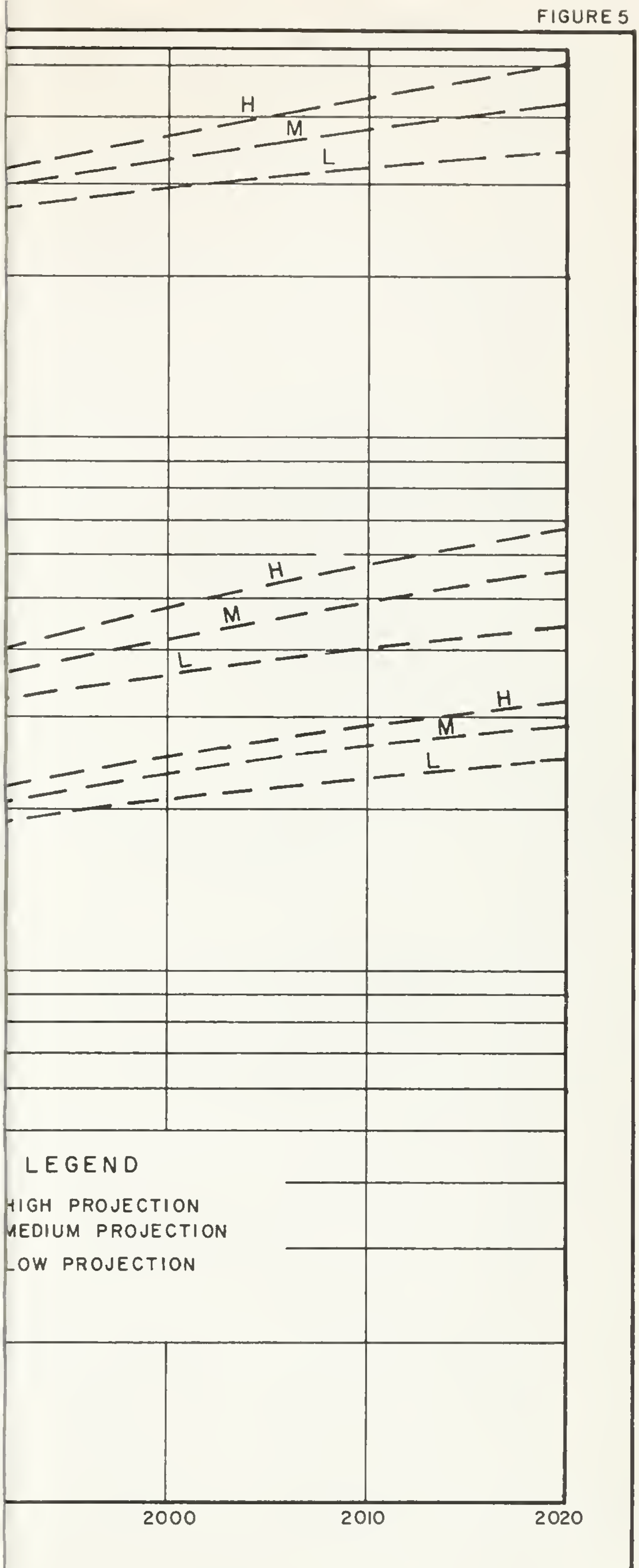
a. Total continental United States population, excluding Alaska and including armed forces overseas.
b. Total California population, including armed forces stationed therein.
c. Historical population as of census date.
d. Projected population as of July 1, date.

Note: L - Low Projection
M - Median Projection
H - High Projection

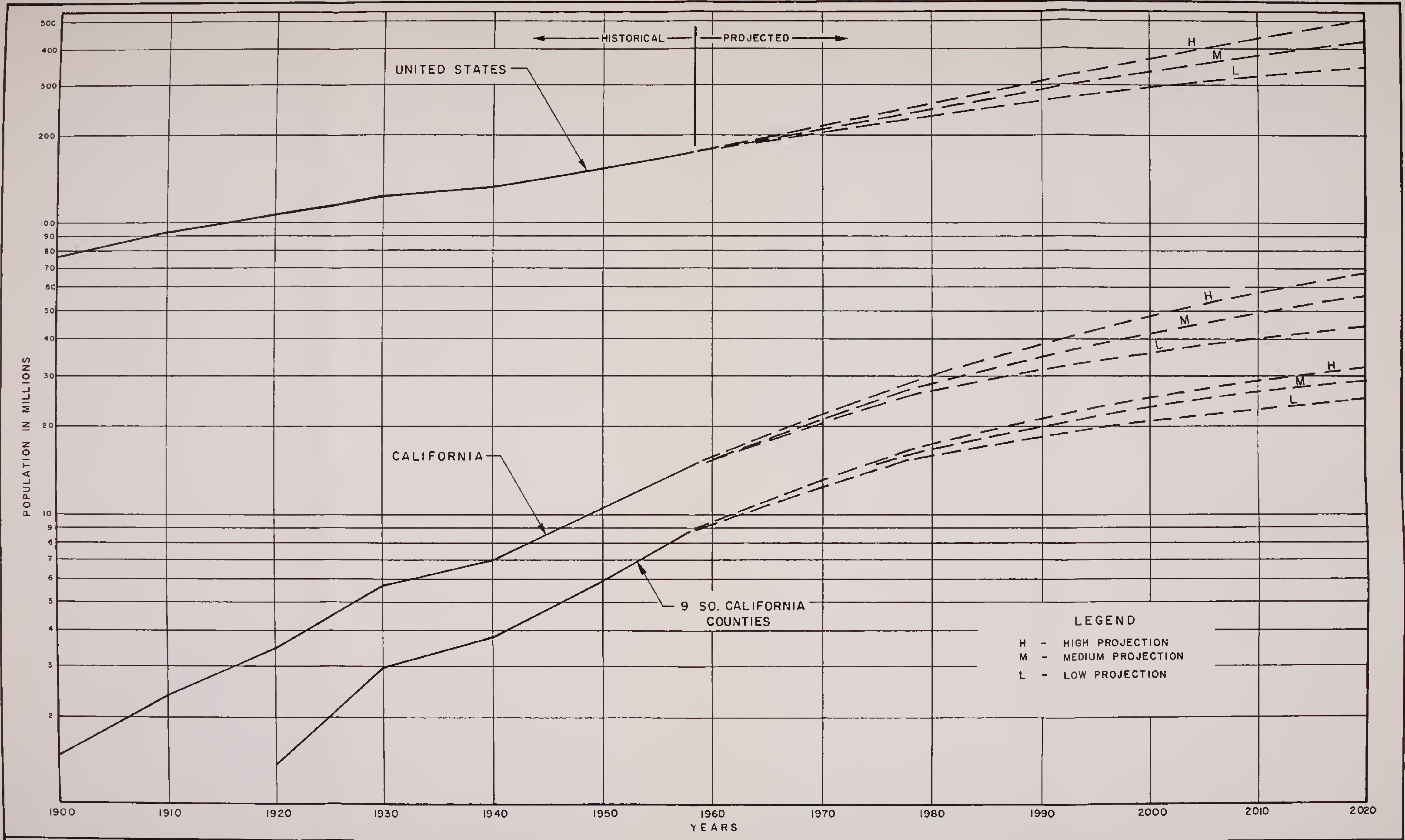
California Population Projection

Population projections on a high, median, and low basis were made for California using the cohort-survival method, as described previously, with minor variations. Migration into California is not controlled; hence the geographical unit of the projection, being the State in this case, is not a completely independent system. Therefore, the same degree of refinement used in the United States cohort-survival projection is not necessary or justifiable in making forecasts for California. The simplification consisted principally of applying growth rates to the total (male and female, combined) population by five-year-age groups up to age 65, while the procedure followed in the

FIGURE 5



IFORNIA COUNTIES



HISTORICAL AND PROJECTED POPULATION OF THE UNITED STATES, CALIFORNIA, AND NINE SOUTHERN CALIFORNIA COUNTIES projection of United States population applied separate rates to males and females by five-year-age groups up to age 85.

The fertility and mortality rates previously defined were used. In-migration to California was projected after investigation of historical in-migration and factors that influenced the rate thereof.

In-migration. In studying historical in-migration to California, several conditions were found to have a major influence on in-migration. These are briefly stated as follows:

(1) California's physical environment of an excellent climate, good recreational areas, interesting geographical features, and vast usable land areas with present low population densities attracts migrants.

(2) Economic opportunities in California are greater than opportunities on a national level, with personal income and plane of living high, good potential for expansion of economic resources, and a large existing and giant potential market for industrial goods with California being the manufacturing center of the west. Land and other resources are favorable to further industrial location. These economic factors act to attract migrants.

(3) The national defense spending policy has resulted in the location in the State of sizable military installations, and the procurement of large percentages of total military aircraft, missiles, and electronics equipment expenditures in the State. With the pools of technical knowledge and labor resulting from this historical development, this pattern of defense spending should continue and contribute to economic opportunities in California.

(4) Growth of the national economy and its resulting advanced technology will allow a wider choice of industrial locations with locations dictated by livability and factors other than transportation and raw materials. With the desirable climatic conditions in California, this will contribute to economic opportunities in the State.

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(4) Growth of the national economy and its resulting advanced technology will allow a wider choice of industrial locations with locations dictated by livability and factors other than transportation and raw materials. With the desirable climatic conditions in California, this will contribute to economic opportunities in the State.

(5) Growth of the national population with resulting higher population densities in older developments, together with the exhaustion of local natural resources that are necessary for economic growth, will force local out-migration from other parts of the nation.

(6) Continuing ease of liquidating fixed assets will increase population mobility as will higher individual earning power. This will remove barriers in the path of migration out of local areas in which the economy is saturated.

These factors have acted to draw migrants to California historically and are expected to continue to act throughout the study period. The relative influence of California's attractions, however, on residents in other states is also influenced by their distance from California. Studies made during the last twenty years have established that interstate migrations decline rapidly with distance of movement. Moreover, a large proportion of interstate migrants to California move to other states before coming to California.

Because of the relatively small populations of the Mountain and Pacific States (excluding California), natives of the West Central States lying between the Mississippi River and the Mountain States comprised more than 45 per cent of the total net migration to California 1930-1940 and 1940-1950. This is graphically shown on Figure 6, and the historical net migration to California by geographical place of birth is tabulated on Table 12.

TABLE 12

HISTORICAL NET MIGRATION TO CALIFORNIA BY GEOGRAPHICAL DIVISION OF BIRTH

(In thousands)

Geographical division of birth[a]	Net California migration during decade[b]							
	1910-20[c]		1920-30[c]		1930-40[d]		1940-50[d]	
	Number	Per cent of total	Number	Per cent of total	Number	Per cent of total	Number	Per cent of total
East	102	12	211	11	92	8	445	17
New England	20	2	42	2	11	1	60	3
Middle Atlantic	66	8	127	7	56	5	253	10
South Atlantic	16	2	42	2	25	2	112	4
East Central	192	22	353	19	155	14	506	19
East North Central	163	19	296	16	118	11	387	15
East South Central	29	3	57	3	37	3	119	4
West Central	223	25	590	31	626	59	1,211	46
West North Central	168	19	400	21	331	31	517	20
West South Central	55	6	190	10	295	28	694	26
West	79	9	284	15	157	15	316	12
Mountain	58	7	209	11	123	12	239	9
Pacific[e]	21	2	75	4	34	3	77	3
Net Military Movement	--	-	--		--		65	2
Foreign Born (Outside U.S.A.)[f]	285	32	444	24	39	4	115	4
TOTAL NET CALIFORNIA MIGRATION	881		1,882		1,069		2,658	

a. Statistical divisions of the United States defined by the United States Bureau of Census.

b. Net migration to California by geographical division of birth. This does not indicate division of residence immediately prior to moving to California.

c. Source of estimates, "Statistical Memorandum No. 6, California Migration" of the Population Committee for the Central Valley Project Studies, College of Agriculture, University of California, Berkeley, July 5, 1944, by C. Reynolds and S. Miles.

d. Estimates by Department of Water Resources based on data on State of Birth of California residents published by the United States Bureau of Census in: 1950 Census of Population, Volume IV, Special Report P.E. No. 4A; 1940 Census of Population, Volume IV, Additional Report T-20; 1930 Census of Population, Volume II, T-21, T-5, T-7.

e. Excluding California.

f. Source of estimates, "Growth and Changes in California's Population", Warren S. Thompson, Haynes Foundation.

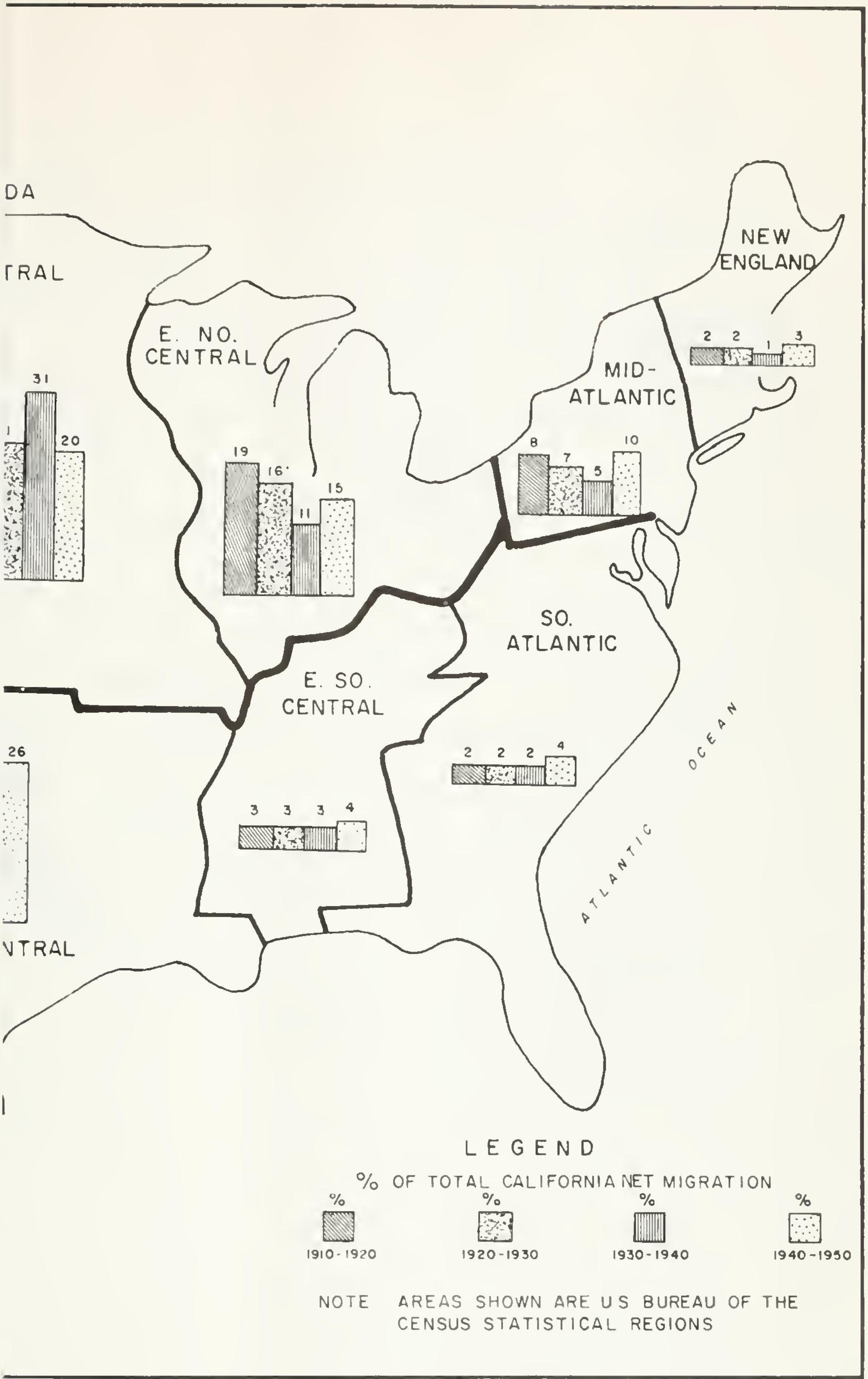
Detailed studies were therefore made of the historical net out-migration from states west of the Mississippi River in relation to the then existing economics and of the outlook for their future economic growth. Trends of changes in patterns of land use and economic activities in these states were analyzed together with the potential expansion of agriculture, industry and commerce.

These studies indicated that many areas in the western states outside California have relatively large potentials for long-term economic development and population growth. Moreover, with the high projected growth of the national population and probable further increase of mobility, it is expected that out-migration will be accelerated from local areas throughout the Nation having relatively stagnant economies and stationary or declining populations, as indicated in the afore-mentioned factor No. 5. Many of these so-called "permanently depressed areas" are emerging in the densely populated Atlantic and East North Central statistical regions. Hence, while a majority of the migrants to California probably will continue to come from west of the Mississippi, the rate of in-migration from states farther east is likely to increase.

It should be noted also that substantial proportions of the net in-migrants as tabulated on Table 12 do not move directly to California from their native states, but only after earlier migration to other states.

Historical data on the number of persons moving between states are available only for the period 1935-1940 and annually since 1947. Data indicating the change in number of persons born in one state but living in

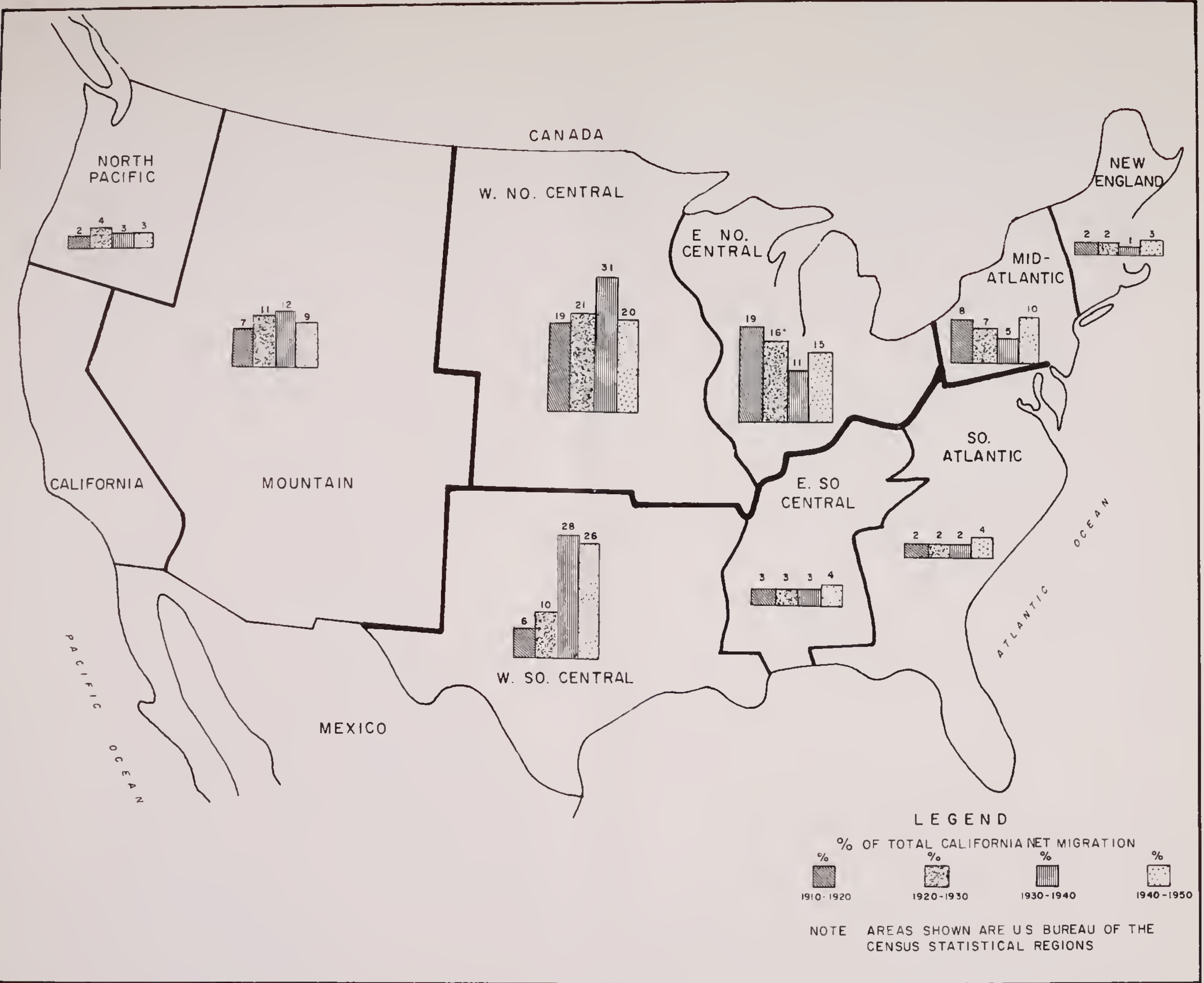
FIGURE 6



NOTE AREAS SHOWN ARE U S BUREAU OF THE CENSUS STATISTICAL REGIONS

S NATIVES MIGRATING TO CALIFORNIA

FIGURE 6



REGION OF BIRTH OF UNITED STATES NATIVES MIGRATING TO CALIFORNIA some other state, however, have been reported by each decennial census since 1850. Table 13 shows the statistical relation of the volume of total net in-migration to California to the total net movement of people from their native state to some other state during each decade 1910-1950.

Table 13 also presents median projections of the similar total net movement of persons from their native state to other states during each decade 1950-2020. These projections were obtained by assuming that the ratio of such movement to the median projection of the population of the United States in age group 20-44 years at beginning of the decade would change as shown by the percentages in Table 13. The assumed percentages were based on expected increases in the propensity and ability of people to move from their native state to some other state, and are consistent with the afore-mentioned detailed analysis of the outlook for future economic growth in the western United States.

The projected net in-migration to California, as tabulated on Table 13, was based on the projection of primary interstate population movement and the extrapolation of the ratio between net California in-migration and the primary interstate migration, which is a good indicator of the propensity of persons to migrate to California. As it is recognized that other sources than the primary interstate movement contribute to the net in-migration to California, the analyses made for the economic growth in the western states were also used in projecting the in-migration. As shown by Table 13, the projected ratio of California migration to interstate migration is conservative when compared with the historical ratio and the assumptions of healthy economic conditions underlying the projections.

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TABLE 13

HISTORICAL AND PROJECTED PRIMARY INTERSTATE MOVEMENT OF NATIVE UNITED STATES POPULATION

(Values in thousands)

Decade	Primary interstate movement of the native United States population[a]		California migration[b]	
	Number of primary movers	As a per cent of total population aged (20-44)	Total net in-migration	Per cent of primary interstate migration
	Historical			
1910-1920	5,991	15.7	881	14.7
1920-1930	7,828	17.9	1,882	24.0
1930-1940	4,397	8.9	1,069	24.3
1940-1950	11,593	21.4	2,658	22.9
	Projected[c]			
1950-1960	15,250	26.5	3,275	21.5
1960-1970	17,200	28.0	3,290	19.1
1970-1980	21,000	28.6	2,720	13.0
1980-1990	26,500	29.1	2,310	8.7
1990-2000	32,000	29.5	2,010	6.3
2000-2010	37,500	29.8	1,630	4.3
2010-2020	43,000	30.1	1,240	2.9

a. Net movement of persons out of their native state and into another state. Historical data based on U. S. Bureau of the Census, "Historical Statistics", series B-183, accounting for mortality.

b. Net migration to California from all sources, including migration of persons from states other than their native state, and immigration of the foreign born as well as migration of persons from their native state.

c. Median projection.

The forecast decline, both in in-migration to California and in the ratio presented on Table 13, was not due to assumptions of depressed economic conditions or a lack of persons with a propensity for migration; rather, the rate of growth of California's economic base was of paramount importance. Studies of economic development and employment opportunities in the State, reported in subsequent paragraphs, indicated that California would not be able to absorb all of the potential in-migrants because of the large numerical natural increase which will be occurring in California. Accordingly, net in-migration was estimated to decline in the far future as the population increase from excess of births over deaths rises. This is illustrated in Table 14 and on Figure 7, which shows the relationship by decades between population growth from natural increase and from in-migration under high, median, and low conditions, and under median conditions, respectively. Distribution of the total net migration by five-year-age groups was based on the historical distribution occurring from 1900 through 1950, and the expected reduction in employment-seeking in-migrants and consequent relative increase in retirement-aged in-migrants. This distribution in the form of the per cent of total migration in each five-year-age group is presented in Table 15.

TABLE 14

HISTORICAL AND PROJECTED COMPONENTS OF CHANGE IN THE CALIFORNIA POPULATION

Year	Population	Total change during decade	Natural increase		Migration (includes military)
			Births	Deaths	
			Historical Components[a]		
1930	5,677,251				
		1,230,130	883,030	721,700	1,068,800
1940	6,907,387				
		3,678,840	1,936,000	915,160	2,658,000
1950	10,586,223				
			Low Projection of Components[b]		
1950	10,609,000[c]				
		5,041,000	3,022,000	1,136,000	3,155,000
1960	15,650,000				
		5,300,000	3,920,000	1,570,000	2,950,000
1970	20,950,000				
		5,350,000	4,760,000	1,980,000	2,570,000
1980	26,300,000				
		4,900,000	5,300,000	2,400,000	2,000,000
1990	31,200,000				
		4,800,000	6,200,000	2,900,000	1,500,000
2000	36,000,000				
		4,300,000	6,700,000	3,400,000	1,000,000
2010	40,300,000				
		3,700,000	7,200,000	3,900,000	400,000
2020	44,000,000				
			High Projection of Components[b]		
1950	10,609,000[c]				
		5,371,000	3,138,000	1,142,000	3,375,000
1960	15,980,000				
		6,420,000	4,730,000	1,620,000	3,310,000
1970	22,400,000				
		7,600,000	6,600,000	2,100,000	3,100,000
1980	30,000,000				
		8,500,000	8,300,000	2,600,000	2,800,000
1990	38,500,000				
		9,300,000	10,100,000	3,200,000	2,400,000
2000	47,800,000				
		10,000,000	11,700,000	3,800,000	2,100,000
2010	57,800,000				
		10,200,000	13,100,000	4,700,000	1,800,000
2020	68,000,000				

HISTORICAL AND PROJECTED COMPONENTS OF CHANGE IN THE CALIFORNIA POPULATION (continued)

Year	Population	Total change during decade	Natural increase: Births	Natural increase: Deaths	Migration (includes military)
		Median Projection of Components[b]			
1950	10,609,000[c]				
		5,221,000	3,120,000	1,174,000	3,275,000
1960	15,830,000[c]				
		5,870,000	4,270,000	1,600,000	3,200,000
1970	21,700,000				
		6,500,000	5,810,000	2,030,000	2,720,000
1980	28,200,000				
		6,800,000	7,000,000	2,500,000	2,300,000
1990	35,000,000				
		7,100,000	8,100,000	3,000,000	2,000,000
2000	42,100,000				
		6,900,000	8,900,000	3,600,000	1,600,000
2010	49,000,000				
		6,800,000	9,900,000	4,300,000	1,200,000
2020	55,800,000				

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a. Historical population enumerated as of census date. (Includes armed forces stationed in California). Source of historical data: U. S. Bureau of the Census Publications.

b. Projected population as of July 1. Projected population and components of change are from the cohort-survival projection of the California population (Tables 82, 84, and 90). While values are rounded to this significance for illustrative purposes, this does not imply an expected level of accuracy in the projection. The 1950 to 1960 components of change are based on 1950 to 1958 estimated annual components of change from the California Department of Finance, Budget Division, "California's Population in 1958", Sacramento: July 1958, and 1950 to 1957 estimated components of change from the U. S. Bureau of the Census, "Current Population Reports", Series P-25, No. 186.

c. Source: California Department of Finance.

TABLE 15

HISTORICAL AND PROJECTED AGE-GROUP DISTRIBUTION OF CALIFORNIA NET MIGRATION

Age at end of decade	Historical net migration during decade										Projected per cent of total net migration[a]
	1900-1910		1910-1920		1920-1930		1930-1940		1940-1950		
	Number	Per cent of total	Number	Per cent of total	Number	Per cent of total	Number	Per cent of total	Number	Per cent of total	
0- 9[b]	56,678	7.31	85,089	9.66	79,180	4.21	57,922	5.52	272,353	10.14	11.65
Over 10[c]	718,622	92.69	795,411	90.34	1,803,020	95.79	992,078	94.48	2,414,747	89.86	88.35
10-14	59,542	7.68	80,774	9.17	155,042	8.24	76,675	7.30	166,295	6.19	7.87
15-19	63,200	8.15	71,883	8.16	156,092	8.29	86,386	8.23	198,023	7.37	10.50
20-24	112,611	14.52	106,831	12.13	225,104	11.96	159,642	15.20	299,588	11.15	12.67
25-29	126,132	16.27	120,814	13.73	263,692	14.02	196,230	18.69	387,724	14.43	11.96
30-34	98,799	12.74	85,722	9.74	221,809	11.78	121,385	11.56	321,400	11.96	9.27
35-39	77,075	9.94	80,053	9.09	198,587	10.55	80,636	7.68	262,507	9.77	7.22
40-44	56,493	7.29	54,681	6.21	157,802	8.38	60,469	5.76	200,198	7.45	5.85
45-49	36,172	4.67	50,371	5.72	---[d]	--[d]	29,701	2.83	140,695	5.24	5.79
50-54	27,647	3.57	40,510	4.60	208,043[d]	11.05[d]	40,700	3.88	117,887	4.39	4.38
55-59	12,938	1.67	24,614	2.80	---[d]	--[d]	23,602	2.25	83,971	3.12	3.36
60-64	19,722	2.54	26,874	3.05	106,414[d]	5.65[d]	27,573	2.62	71,335	2.65	3.50
65+	28,291	3.65	52,284	5.94	110,435	5.87	89,079	8.48	165,124	6.14	5.98
TOTALS[e]	775,300		880,500		1,882,200		1,050,000		2,687,100		100.00

a. Projected by Department of Water Resources. Based on the historical data adjusted to age at time of entry, and adjusted for expected future reduction in the per cent of migrants in the 20 through 44 age groups.

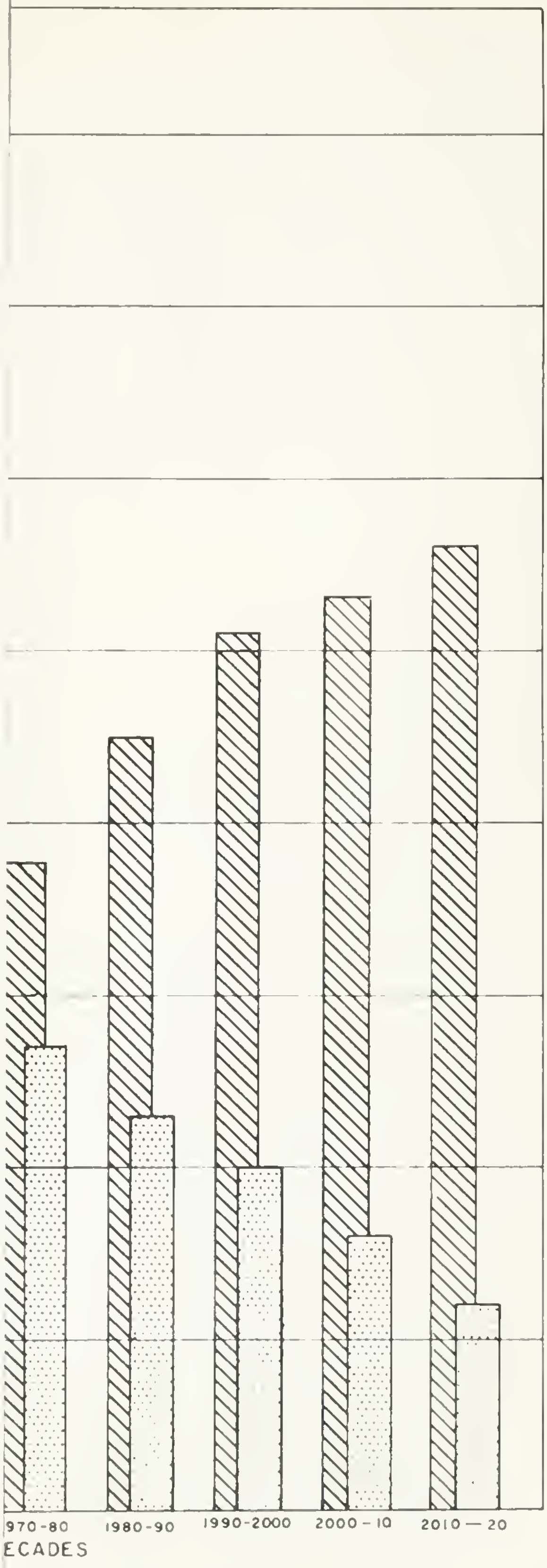
b. Computed by Department of Water Resources as difference between net migration and migrants over 10.

c. Source: W. S. Thompson, "Growth and Changes in California's Population", Table III-7, Net Effective Migration of Persons into California, by age and sex, 1880 to 1950.

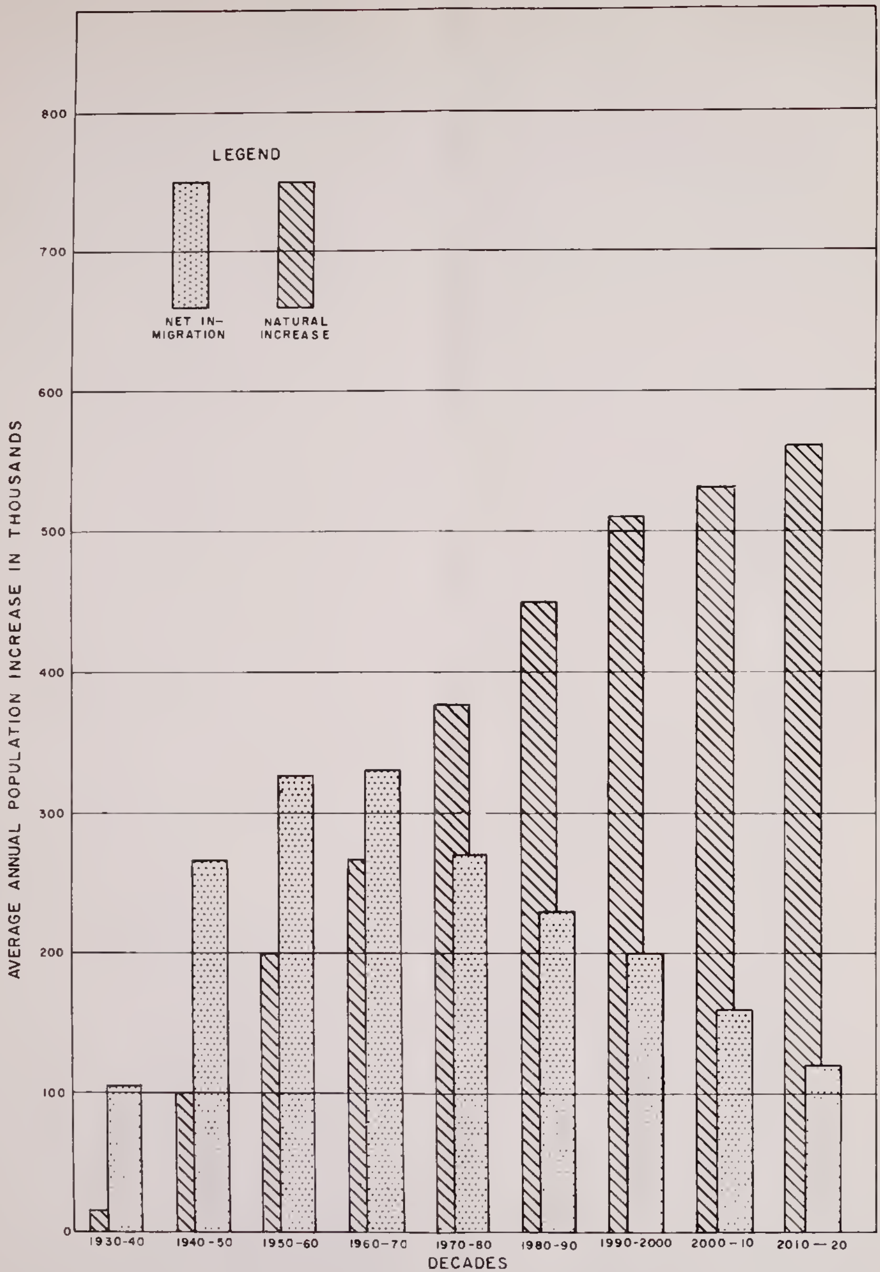
d. Data for age groups 45-49 and 50-54 combined into one age group 45-54, and data for age groups 55-59 and 60-64 combined into one age group 55-64 for this period of time.

e. Source: W. S. Thompson, "Growth and Changes in California's Population", Table III-4, Survivors at End of Decade of Migrants during Decade.

FIGURE 7



SOURCES OF POPULATION INCREASE
EDIAN PROJECTION



HISTORICAL AND PROJECTED SOURCES OF POPULATION INCREASE IN CALIFORNIA—MEDIAN PROJECTION

Computation of Projected California Population

The State's base population and age-group distribution for 1955 were taken from a bulletin of the Budget Division of the California Department of Finance entitled "California's Population in 1958", July, 1958. This base population was aged by successive five-year periods by application of the growth rates described above. First, each five-year-age group in the beginning population and one-half of the migrants for the particular five-year span and age group were aged by applying the appropriate survival factor. To these survivors were added the one-half of the migrants for the same time span in the next oldest age group to which survival rates were not applied. This sum then became the next oldest age group at the next five-year point in time.

The size of the 0-4 age group for each five-year point in time was computed in the following steps. First, the average gross reproduction rate during each five-year span was calculated through multiplying the projected United States gross reproduction rate by the extrapolated ratio of this rate with California's rate, with results as tabulated in Attachment No. 5, Table No. 80. Five-year-age group annual specific birth rates corresponding to this gross reproduction rate were then taken from the idealized correlation curves on Figure 4. These annual rates were multiplied by five, with resulting rates as shown on Table No. 81, Attachment No. 5, and then applied to the estimated average number of women in each producing age group during that five-year span to obtain the number of births. The number of women in each child producing age group was taken as one-half of the average of the total population in that age group at the beginning and end of the span.

Computation of Projected California Population

The State's base population and age-group distribution for 1955 were taken from a bulletin of the Budget Division of the California Department of Finance entitled "California's Population in 1958", July, 1958. This base population was aged by successive five-year periods by application of the growth rates described above. First, each five-year-age group in the beginning population and one-half of the migrants for the particular five-year span and age group were aged by applying the appropriate survival factor. To these survivors were added the one-half of the migrants for the same time span in the next oldest age group to which survival rates were not applied. This sum then became the next oldest age group at the next five-year point in time.

The size of the 0-4 age group for each five-year point in time was computed in the following steps. First, the average gross reproduction rate during each five-year span was calculated through multiplying the projected United States gross reproduction rate by the extrapolated ratio of this rate with California's rate, with results as tabulated in Attachment No. 5, Table No. 80. Five-year-age group annual specific birth rates corresponding to this gross reproduction rate were then taken from the idealized correlation curves on Figure 4. These annual rates were multiplied by five, with resulting rates as shown on Table No. 81, Attachment No. 5, and then applied to the estimated average number of women in each producing age group during that five-year span to obtain the number of births. The number of women in each child producing age group was taken as one-half of the average of the total population in that age group at the beginning and end of the span.

The sum of the births to these groups during the span was survived by the 0-4 survival rate for that particular five-year span as tabulated in Attachment No. 5, Table No. 83. These survivors plus one-half of the migrants aged 0-4 during that span became the 0-4 group at the end of the span.

Projected California Population. The high, median, and low projections of the State's population, resulting from applications of high, median, and low fertility and in-migration rates and median mortality rates to California's present population, are shown on Tables 11 and 14, and Figure 5. As the ratios tabulated in Table 11 between California's and the nation's population show, California's population is estimated to continue to increase more rapidly than that of the United States, with the difference between the rates declining. Tables 88, 89, and 90, presenting the State's high, median, and low age-group projections by five-year intervals, are contained in Attachment No. 7.

The median population projection was adopted for reasons as stated before and was used in developing urban water requirements. This projection indicates that in the year 2020 the State may reasonably be expected to contain nearly four times its present population of 14,750,000, or about 56 million persons. Corresponding "high" and "low" projections for that date are 68 and 44 millions, respectively.

Regional Distribution of California's Population

The population of California was distributed among eight study regions comprising all of the State, which regions are defined in Table 16 and depicted on Figure 8. This procedure was followed to insure that the probable growth projected for southern California was consistent with the probable future growth of all regions of California, as well as that of the State itself. The future regional populations were estimated by first determining the probable distributions of the State's high, median, and low populations in the year 2020, and then determining the relative regional growth rates from the present to year 2020.

The year 2020 distributions of the State's population projections were based upon analyses of probable long-term population capacities of the regions, particularly the metropolitan regions. Major factors considered in the analyses of year 2020 population distribution were as follows:

(1) Nature and extent of lands in each region as described in State Water Resources Board Bulletin No. 2 and publications of this Department.

(2) Trends in urban densities and resulting land requirements for projected populations in each region.

(3) Comparative livability of each region.

(4) Probable pattern of future economy of each region and relative rates of economic growth.

(5) Historical patterns of population distribution by region.

The relative growth rates of regions throughout the study period were estimated through analyzing (1) the relative patterns of historical growth of regions; (2) the existing and expected future economy of each region, based upon detailed assumptions of future social and economic conditions; (3) the relative potential for growth among the regions at varying

TABLE 16

HISTORICAL AND PROJECTED REGIONAL DISTRIBUTION OF POPULATION IN CALIFORNIA

(Median Projection)

Year	California		I 9 Southern California Counties			II 9 Bay Area Counties			III 15 Northeastern Counties			IV 3 Central Coastal Counties		
	Total population	10 year increase, per cent	Population	Per cent of California	10 year increase, per cent	Population	Per cent of California	10 year increase, per cent	Population	Per cent of California	10 year increase, per cent	Population	Per cent of California	10 year increase, per cent
							Historical							
1900	1,485,053		337,328	22.71		658,111	44.32		131,692	8.87		47,525	3.20	
		60.1			135.6			40.7			14.5			22.7
1910	2,377,549		794,817	33.43		925,708	38.94		150,800	6.34		58,327	2.45	
		44.1			73.7			27.8			8.0			8.4
1920	3,426,861		1,380,333	40.28		1,182,911	34.52		162,905	4.75		63,244	1.84	
		65.7			116.2			33.4			22.2			62.0
1930	5,677,251		2,984,075	52.56		1,578,009	27.80		199,089	3.51		102,449	1.80	
		21.7			26.7			9.9			25.2			26.4
1940	6,908,387		3,780,993	54.74		1,734,308	25.11		249,298	3.61		129,481	1.87	
		53.3			55.2			54.6			32.5			63.3
1950	10,586,223		5,869,000	55.44		2,681,322	25.33		330,399	3.12		211,402	2.00	
1958	14,752,000	49.5	8,705,500	59.01	59.8	3,492,700	23.68	39.1	380,900	2.58	19.6	278,900	1.89	39.3
							Projected							
1960	15,830,000		9,380,000	59.25		3,730,000	23.56		395,000	2.50		294,500	1.86	
		37.1			39.7			32.7			31.6			37.5
1970	21,700,000		13,100,000	60.37		4,950,000	22.81		520,000	2.40		405,000	1.87	
		30.0			28.5			27.5			34.6			44.7
1980	28,200,000		16,838,000	59.71		6,310,000	22.38		700,000	2.48		586,000	2.08	
		24.1			18.3			22.3			44.1			45.9
1990	35,000,000		19,920,000	56.90		7,715,000	22.04		1,009,000	2.88		855,000	2.44	
		20.0			15.9			18.5			43.7			36.3
2000	42,000,000		23,080,000	54.95		9,145,000	21.77		1,450,000	3.45		1,165,000	2.77	
		16.7			12.5			15.0			34.5			26.2
2010	49,000,000		25,955,000	52.93		10,515,000	21.46		1,950,000	3.98		1,470,000	3.00	
		14.3			10.0			12.2			30.8			19.0
2020	56,000,000		28,550,000	50.98		11,800,000	21.07		2,550,000	4.55		1,750,000	3.12	

HISTORICAL AND PROJECTED REGIONAL DISTRIBUTION OF POPULATION IN CALIFORNIA

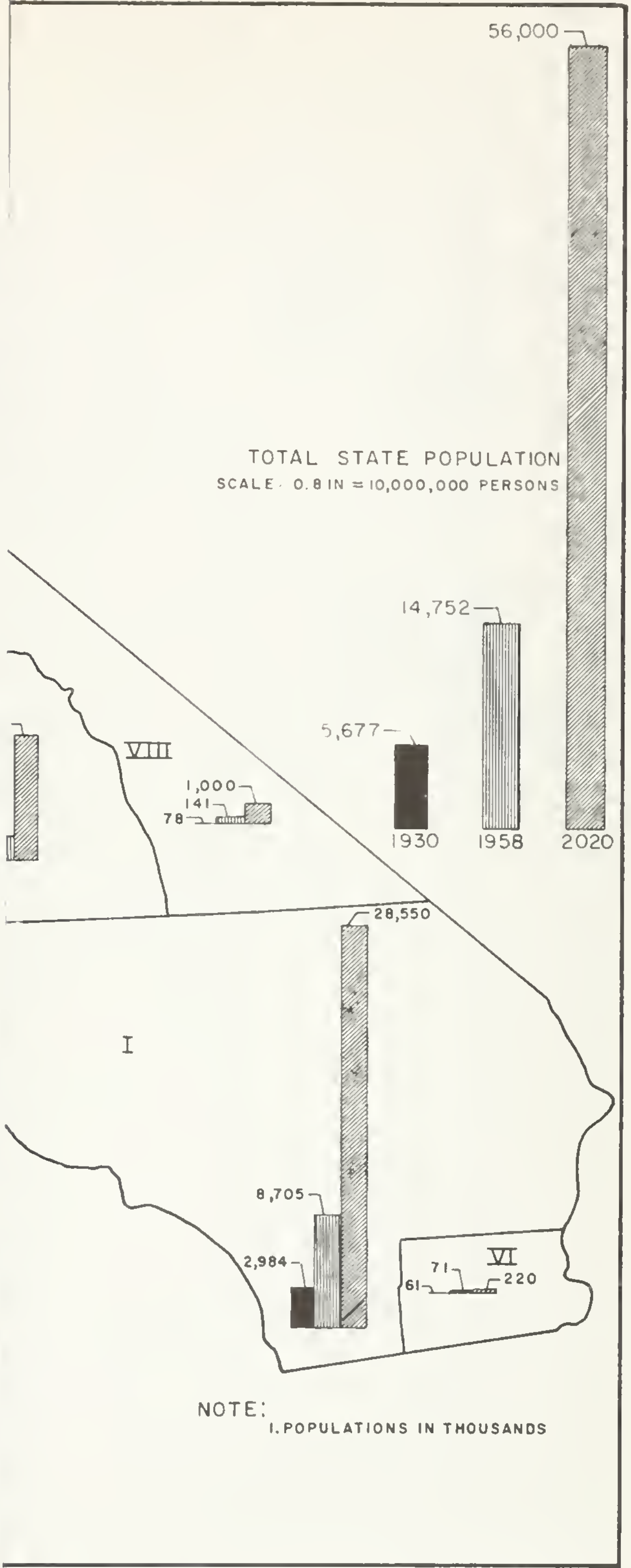
(Median Projection)
(continued)

Year	V 8 San Joaquin Valley Counties Population	V 8 San Joaquin Valley Counties Per cent of California	V 8 San Joaquin Valley Counties 10 year increase, per cent	VI Imperial County Population	VI Imperial County Per cent of California	VI Imperial County 10 year increase, per cent	VII 3 North Coastal Counties Population	VII 3 North Coastal Counties Per cent of California	VII 3 North Coastal Counties 10 year increase, per cent	VIII 10 Mountain Counties Population	VIII 10 Mountain Counties Per cent of California	VIII 10 Mountain Counties 10 year increase, per cent
Historical												
1900	172,604	11.62					49,977	3.36		87,816	5.91	
1910	291,902	12.28	69.1	13,591	0.57		60,203	2.53	20.5	82,201	3.46	- 6.4
1920	461,114	13.46	58.0	43,453	1.27	219.7	64,288	1.88	6.8	68,613	2.00	-16.5
1930	602,698	10.62	30.7	60,903	1.07	40.1	71,477	1.26	11.2	78,551	1.38	14.5
1940	770,593	11.16	27.9	59,740	0.86	- 1.9	78,421	1.14	9.7	104,553	1.51	33.1
1950	1,184,412	11.19	53.7	62,975	0.59	5.4	118,173	1.12	50.7	128,540	1.21	22.9
1958	1,513,500	10.26	36.5	70,800	0.48	15.9	168,800	1.14	52.3	140,900	0.96	24.5
Projected												
1960	1,617,000	10.22		73,000	0.46		180,000	1.14		160,000	1.01	
1970	2,170,000	10.00	34.2	93,000	0.43	27.4	245,000	1.13	36.1	217,000	1.00	35.6
1980	2,998,000	10.63	38.2	120,000	0.43	29.0	338,000	1.20	38.0	310,000	1.10	42.9
1990	4,428,000	12.65	47.7	146,000	0.42	21.7	490,000	1.40	45.0	437,000	1.25	41.0
2000	5,706,000	13.59	28.9	173,000	0.41	18.5	692,000	1.65	41.2	589,000	1.40	34.8
2010	7,235,000	14.76	26.8	200,000	0.41	15.6	926,000	1.89	33.8	769,000	1.57	30.6
2020	9,000,000	16.07	24.4	220,000	0.39	10.0	1,200,000	2.14	29.6	1,000,000	1.79	30.0

HISTORICAL AND PROJECTED REGIONAL DISTRIBUTION
OF POPULATION IN CALIFORNIA

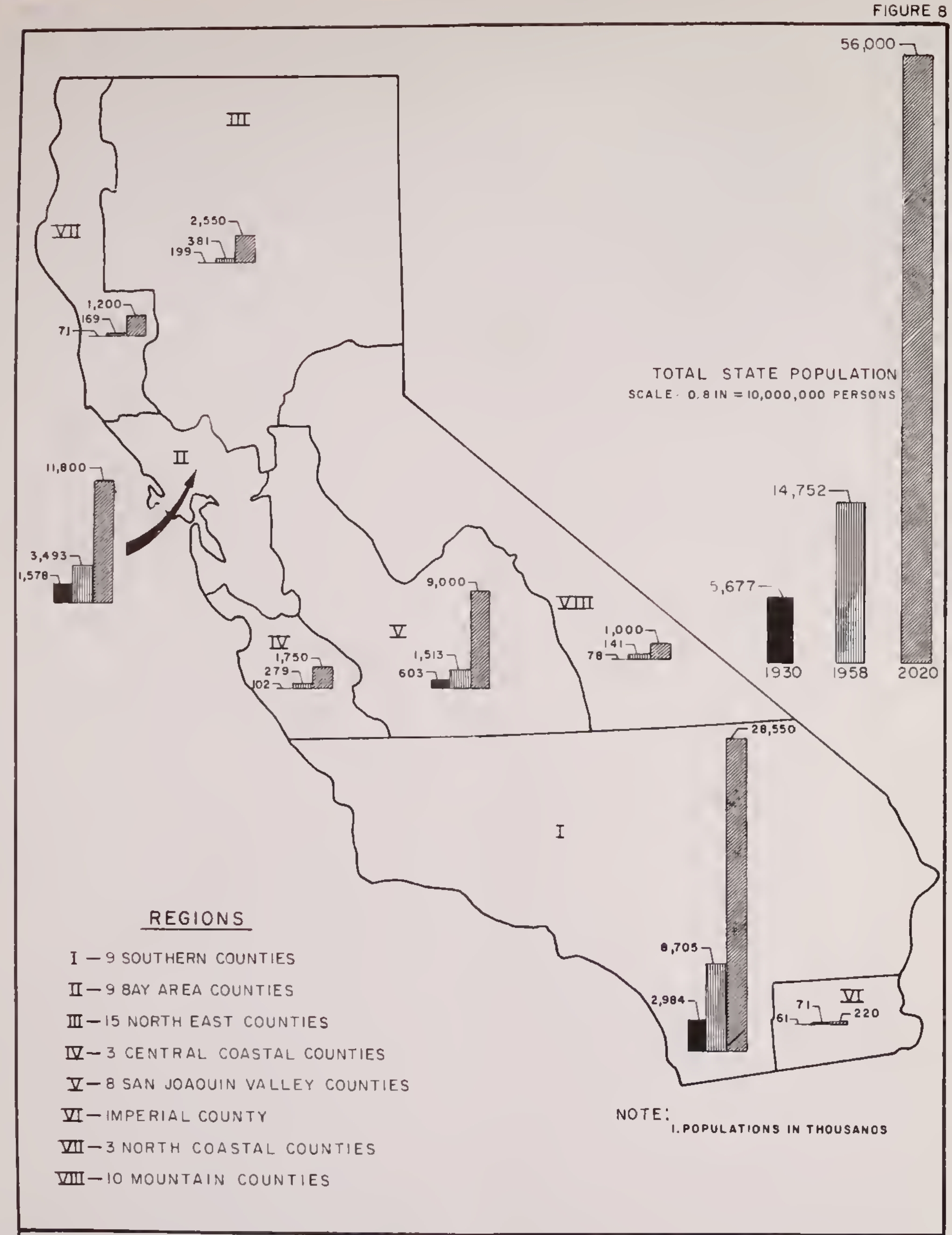
(Median Projection)
(continued)

			Description of Study Regions
I.	9 Southern California Counties	-	Los Angeles; Orange; Riverside; San Bernardino; San Diego; Santa Barbara; Ventura; Kern; San Luis Obispo.
II.	9 Bay Area Counties	-	Alameda; Contra Costa; Marin; Napa; San Francisco; San Mateo; Santa Clara; Solano; Sonoma.
III.	15 Northeastern Counties	-	Butte; Colusa; Glenn; Lake; Lassen; Modoc; Plumas; Shasta; Sierra; Siskiyou; Sutter; Tehama; Trinity; Yolo; Yuba.
IV.	3 Central Coastal Counties	-	Monterey; San Benito; Santa Cruz.
V.	8 San Joaquin Valley Counties	-	Fresno; Kings; Madera; Meroed; Sacramento; San Joaquin; Stanislaus; Tulare.
VI.	Imperial County	-	
VII.	3 North Coastal Counties	-	Del Norte; Humboldt; Mendocino.
VIII.	10 Mountain Counties	-	Alpine; Amador; Calaveras; El Dorado; Inyo; Mariposa; Mono; Nevada; Placer; Tuolumne.



OJECTED DISTRIBUTION
RNIA – MEDIAN PROJECTION

FIGURE 8



HISTORICAL AND PROJECTED DISTRIBUTION
OF POPULATION IN CALIFORNIA — MEDIAN PROJECTION

DEPARTMENT OF WATER RESOURCES

stages of future growth; (4) the tentative 2020 populations of each region; and (5) the data contained in previously published studies of population and economic development of the various regions by the Department and others.

In developing the regional forecasts within the framework of the State's projections, special weight was given to region-State relationships and attention was focused on the population increase, in per cent, of each region during each decade. The forecasts of each region's population growth which were produced conform to a pattern of growth which can be separated into three general phases.

The first phase exists for long periods of time and is marked by slow rates of increase or decrease in population governed by the changing technology of local economic activities. During this period, the local activities are usually based on the exploitation of natural resources, such as mining, forestry, and agriculture.

The second phase is usually characterized by rapid population increases. Where the pressures and stimulation of the regional growth are strong, the rate of increase usually reaches high peaks. Under moderate pressures, the rate of increase usually exhibits more even trends. During this second phase, economic activities in the region reflect a shift in emphasis and are based on urban sources of income, such as manufacturing, trade, finance, and governmental employment.

The last phase is characteristic of a mature economy, with growth rates declining and the direction of change indefinite.

While regions as a whole may be passing through one of these phases, individual counties or other subdivisions of these regions may be experiencing quite different phases of growth. To illustrate, the City and County of San

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While regions as a whole may be passing through one of these phases, individual counties or other subdivisions of these regions may be experiencing quite different phases of growth. To illustrate, the City and County of San

Francisco has experienced a mature, or phase three, economy for over 30 years, with its rate of population growth alternately increasing and decreasing throughout this period. During the same time, Solano and Sonoma Counties have been in phase one, while the San Francisco Bay Area region, as a whole, has been in phase two.

Simultaneously with the regional analyses, projections were made of the populations of individual counties in the San Francisco Bay Area and in southern California. These projections were based on similar but more intensive analyses of the factors used in the regional studies. The summations of individual county forecasts were compared with regional projections.

Adjustments were made in the projections resulting from both of the above procedures where logical development indicated conflicts between results therefrom. The resulting distributions of the State population projections represent a hierarchy of mutually consistent regional population projections.

The historical and projected distribution of California's median population by these regions is shown in Table 16 and Figure 8. The projected growth over the next sixty years approaches a ten times increase in some of the rural regions of California which will be entering into phase two, or rapid growth periods, within the next 10 to 20 years. In the San Francisco Bay Area and southern California regions, which include the major metropolitan areas of the State, the growth is expected to result in over a three times increase with the rate of increase rapidly tapering off after the ensuing 20 years.

The rapid decline in rate of increase in the established metropolitan regions after 1980 will cause an upsurge in the region or regions best able to experience extremely rapid urbanization at that time. All of the nonurban regions exhibit peak rates of growth, therefore, between 1980 and 2000; as the San Joaquin Valley region appeared particularly adapted to the rapid urbanization forecasted, the population increase from the year 1980 to the year 2000 in this latter area is projected as being at the highest rate of any region in the State.

As shown graphically on Figure 8, even though the southern California region's population growth is much less, percentagewise, than the others, its numerical increase to 28.55 millions by year 2020 is far greater than the forecast for any other region.

Forecasts of each region's population under "high" and "low" conditions are tabulated in Table No. 91, Attachment No. 8. With the "high" and "low" estimates of the State's population as determined previously, the corresponding southern California region's population would be 32 and 25 millions, respectively, in year 2020.

The projected growth in the southern California region as described above was further verified through investigation of the expected magnitude of the basic components of change of natural increase and net migration. The results of this investigation indicate that the pattern of regional distribution of California's in-migrants over the study period is logical and consistent with the basic assumptions. The southern California region, which over the past 15 years has attracted over sixty per cent of the migrants to California, will, under the projected growth rates, receive a constantly declining percentage of future migrants while presently slow growing regions, especially the San Joaquin Valley and the Central Coastal regions, will receive increasing proportions of migrants to the State.

Population of Southern California Counties

The procedure followed in distributing the projected regional population to counties was similar to that previously described in connection with the regional distribution of the State's population, with the County populations derived through considerations of both local trends and the overall regional growth trends. These considerations are necessary in accurately forecasting the future conditions as the levels and patterns of economic activity, population, irrigated agriculture, and other uses of land and natural resources in any one county within the region are interrelated with the entire region. Therefore, substantial changes in any of these categories in any county will induce changes throughout the entire region.

Some of the special considerations on a county level included recent industrial employment trends, changes in size and nature of military establishments either proposed or in progress, activities of private developers, and actions of local and State governmental agencies. The most notable recent influence on local county population growth patterns in the southern California area is in the reactivation of the Camp Cooke military reservation in Santa Barbara County as Vandenberg Air Force Base and Point Arguello Naval Air Missile Test Center. The activity due to these bases has already caused a substantial rise in the county's population and will act to promote growth in the county for the next 10 to 20 years at a rate higher than would otherwise be expected. It should be noted, however, that the population of Santa

Barbara projected for the year 2020 would be decreased by only about five per cent if the bases again become inactive.

The projected population for the Antelope-Mojave Service Area, derived herein, is in close agreement through the year 1990 with the projections in Appendix A of Bulletin No. 78, prepared under contract by the firm of Booz, Allen and Hamilton. Thereafter, the difference between the two projections increases with the Appendix A projection being substantially greater by the year 2020. The basic cause of this difference appears to lie in the projected relationships between this area and the other regions of the State. The projections reported herein are based upon studies encompassing all regions of the State and the future economic interrelationships thereof, which were beyond the scope of the investigation reported in Appendix A.

In any event, both projections show that California's continuing population explosion will force the creation in 60 years or less of a large metropolis in the Antelope-Mojave Desert, one which will exceed the present populations of all but eight of the leading metropolitan areas in the nation.

The county projections of population resulting from the analyses are listed in detail in Table No. 92, Attachment No. 9, and are summarized on Table 17. Each county's projected population is shown on Figure 9. Figure 10 depicts graphically the distribution of population over southern California by showing the relative population projected for each county over the study period at twenty-year intervals. It will be noted that Los Angeles County maintains its pre-eminence throughout the study period, even though its growth after 1990 indicates nearly complete urban saturation. The more open and remote areas, such as San Luis Obispo County, exhibit relatively slow rates of growth up to 1990 with most of the increases therein occurring after that date.

TABLE 17

PRESENT AND PROJECTED POPULATION IN THE SOUTHERN CALIFORNIA AREA[a]

(In thousands of persons)

Area	1958	1960	1970	1980	1990	2000	2010	2020
San Diego County	943.4	1,020	1,455	1,900	2,350	2,800	3,150	3,455
Coastal San Diego County	941.5	1,018	1,452	1,895	2,341	2,784	3,110	3,396
Southwestern Riverside County[b]	2.0	2.3	2.9	3.7	4.5	6.3	7.6	8.5
Present Metropolitan Water District Service Area[b]	875.3	960	1,369	1,789	2,201	2,585	2,837	3,055
Riverside County	258.2	279	443	710	1,120	1,680	2,260	2,700
Coastal Riverside County[b]	184.6	200	322	525	840	1,275	1,730	2,080
Present Metropolitan Water District Service Area	161.9	180	281	482	770	1,159	1,550	1,840
San Bernardino County	470.5	513	830	1,310	1,975	2,610	3,150	3,550
Coastal San Bernardino County	402.3	449	695	1,029	1,482	1,894	2,270	2,580
Present Metropolitan Water District Service Area	121.6	144	208	306	531	754	958	1,128
Los Angeles County	5,792	6,185	8,078	9,700	10,310	10,660	10,880	11,100
Coastal Los Angeles County	5,731	6,115	7,898	9,270	9,632	9,808	9,908	10,015
Present Metropolitan Water District Service Area	5,087	5,460	7,014	8,098	8,326	8,474	8,551	8,630
Orange County	596.8	692	1,320	1,900	2,320	2,620	2,800	2,950
Present Metropolitan Water District Service Area	591.5	675	1,298	1,857	2,243	2,475	2,621	2,747
TOTALS - PRESENT METROPOLITAN WATER DISTRICT SERVICE AREA	6,837	7,419	10,170	12,532	14,070	15,447	16,517	17,400

PRESENT AND PROJECTED POPULATION IN THE SOUTHERN CALIFORNIA AREA[a]
(continued)

(In thousands of persons)

Area	1958	1960	1970	1980	1990	2000	2010	2020
TOTALS - SOUTHERN CALIFORNIA COASTAL PLAIN AND COASTAL SAN DIEGO COUNTY	7,856	8,476	11,690	14,623	16,620	18,387	19,826	21,030
Ventura County	175.3	182	288	425	635	1,000	1,350	1,700
TOTALS - SOUTHERN COASTAL AREA	8,031	8,658	11,978	15,048	17,255	19,387	21,176	22,730
Santa Barbara County[c]	123.5	148	207	283	385	520	695	915
San Luis Obispo County[c]	66.5	70	92	130	205	340	520	700
TOTALS - SANTA BARBARA AND SAN LUIS OBISPO COUNTIES	190.0	218	299	413	590	860	1,215	1,615
Antelope-Mojave Service Area[d]	142.0	157	330	726	1,188	1,619	1,951	2,222
Whitewater-Coachella Service Area[e]	54.0	60	99	159	249	367	488	575
Kern County	279.4	291	385	480	620	850	1,150	1,480
Kern County Service Area	241.4	249	325	395	503	685	922	1,184
TOTALS - SOUTHERN CALIFORNIA	8,706	9,380	13,100	16,838	19,920	23,080	25,955	28,550

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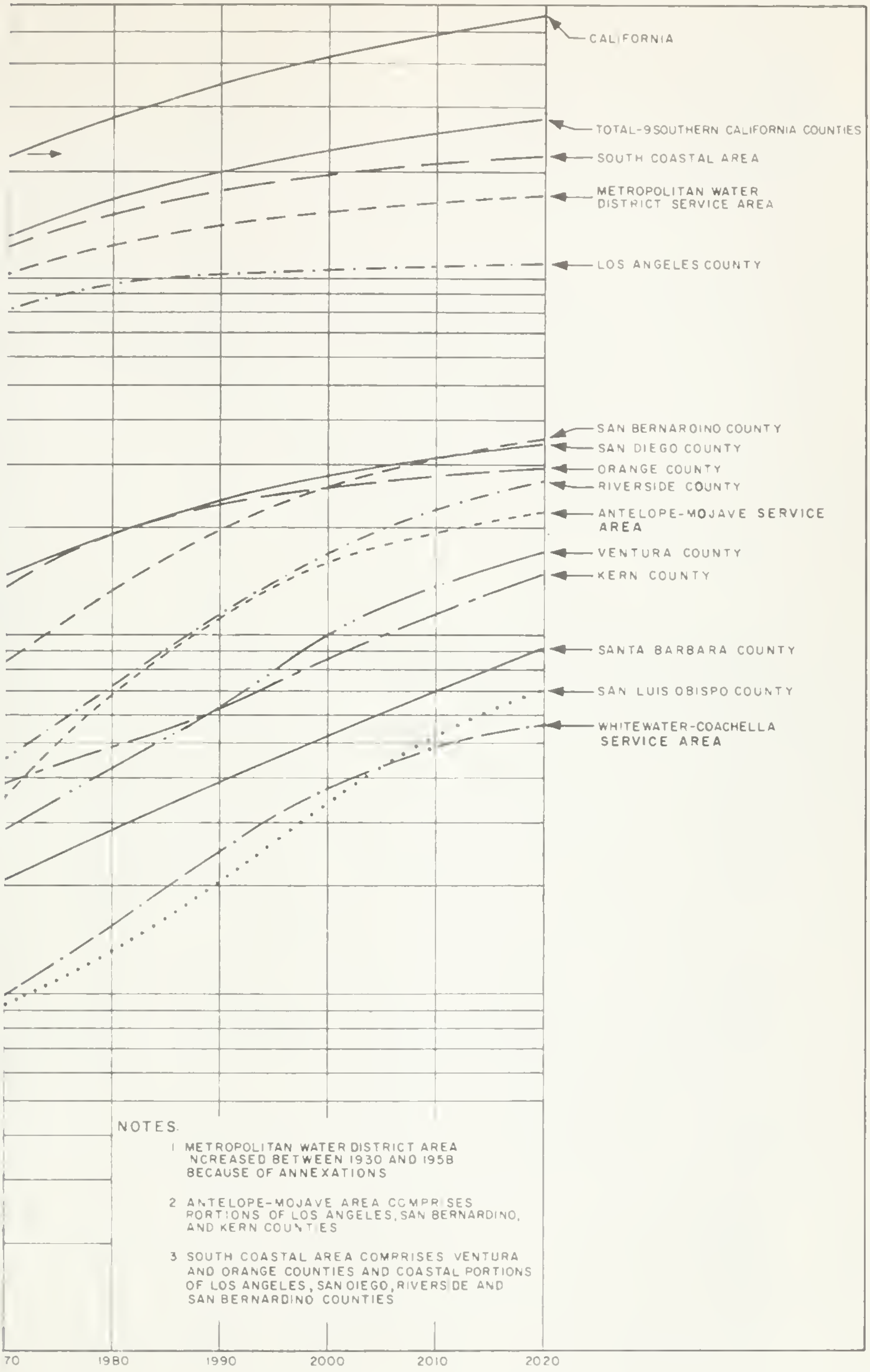
a. Median population projection.
b. That portion of Coastal Riverside County that will be served from the San Diego Aqueduct is tabulated with San Diego County.
c. Differences in the population projected in these counties and the corresponding service areas are negligible.
d. Comprises portions of Kern, Los Angeles and San Bernardino Counties.
e. Portion of Colorado Desert Area in Riverside County.

Population of Subunits

Although analytical studies may define the patterns of historical distribution of population growth throughout a metropolitan area, or any large geographical area, and may justify the use of the historical pattern for predicting further growth as modified by the assumed future conditions, such studies never completely predict the growth in a particular subunit of the area. The factors influencing the individual case are usually too numerous for all to be included in the analysis preceding the forecast of population growth. Moreover, the distribution of population growth within a region is largely determined by decisions of influential individuals and groups, and although the progress in human planning and action generally follows a predictable pattern, it is not always possible to narrow down its impact to an exact locality and time period. Therefore, none of the subunits of the counties, or, indeed, the counties themselves, will receive precisely its expected share in the county or regional population increase. Higher growth rates than those forecast might easily occur in one subunit while an adjacent subunit experiences correspondingly lower rates of growth.

In recognition of this limitation on the accuracy of any pattern of population distribution, care was exercised through all phases of the study to tie each subunit's projected growth pattern to firm points of control. The factors which might influence growth particular to each subunit were investigated in detail and an attempt made to develop a logical pattern of growth based on these factors. The methods described in the following paragraphs are the results of an attempt to dig deeper than the usual application of general growth patterns to each small unit in order that the probable deviation of actual growth from the forecast development would be minimized.

FIGURE 9



NOTES.

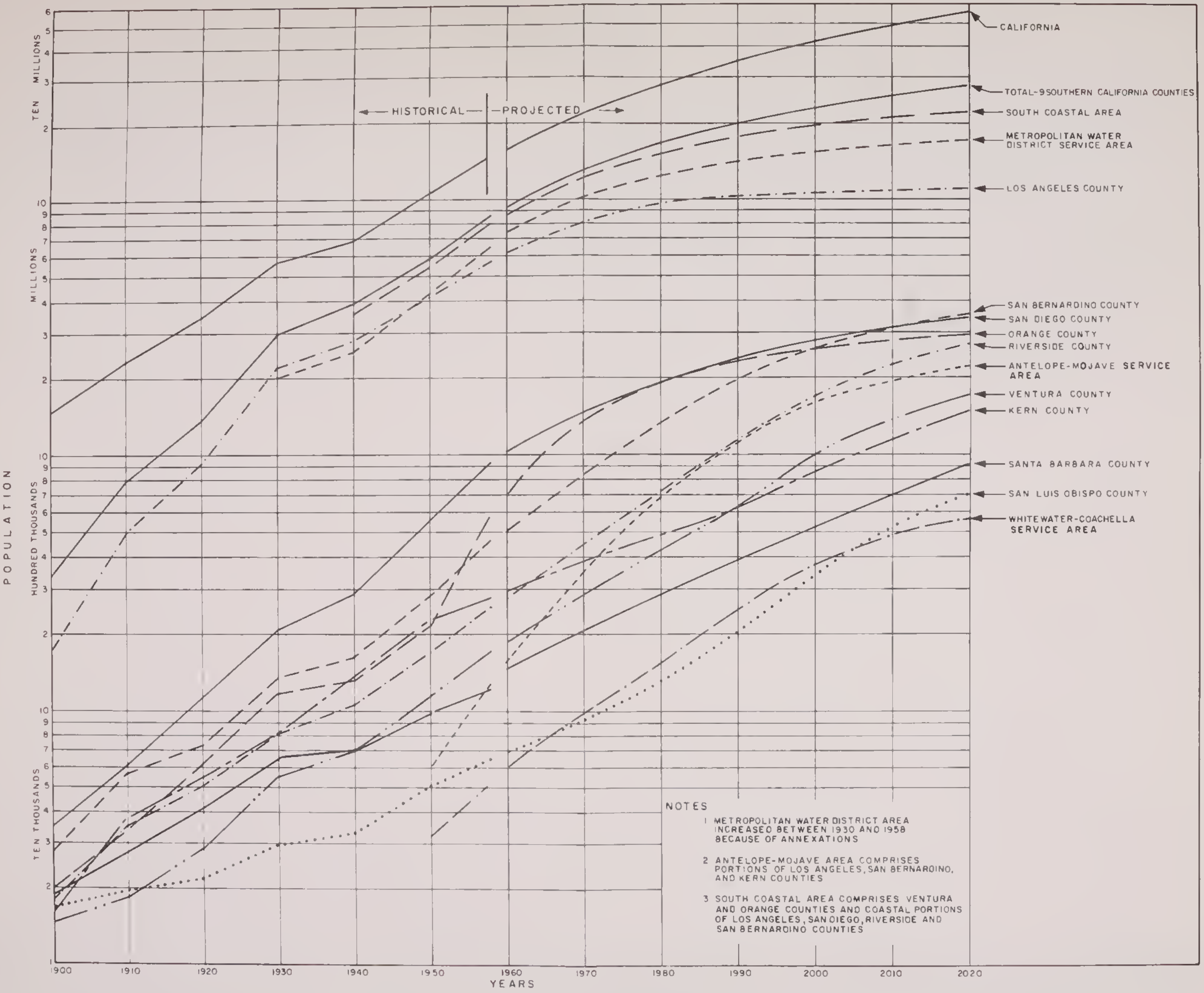
1 METROPOLITAN WATER DISTRICT AREA INCREASED BETWEEN 1930 AND 1958 BECAUSE OF ANNEXATIONS

2 ANTELOPE-MOJAVE AREA COMPRISES PORTIONS OF LOS ANGELES, SAN BERNARDINO, AND KERN COUNTIES

3 SOUTH COASTAL AREA COMPRISES VENTURA AND ORANGE COUNTIES AND COASTAL PORTIONS OF LOS ANGELES, SAN DIEGO, RIVERSIDE AND SAN BERNARDINO COUNTIES

LIFORNIA AND SELECTED SOUTHERN CALIFORNIA AREAS

FIGURE 9



NOTES

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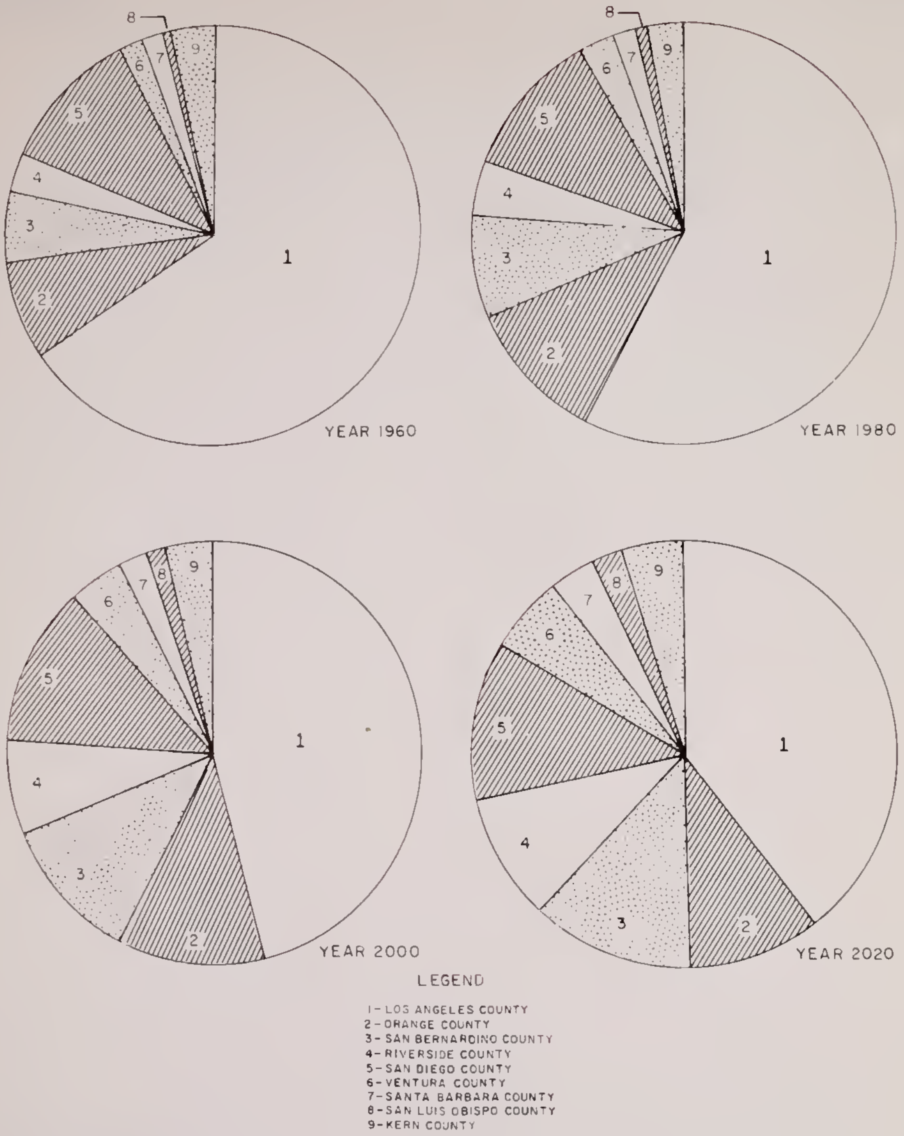
HISTORICAL AND PROJECTED MEDIAN POPULATION IN CALIFORNIA AND SELECTED SOUTHERN CALIFORNIA AREAS

DEPARTMENT OF WATER RESOURCES 1959

FIGURE 10



PROJECTED RELATIVE DISTRIBUTION OF POPULATION
OF NINE SOUTHERN CALIFORNIA COUNTIES

DEPARTMENT OF WATER RESOURCES

Accordingly, a special study employing the "concentric theory of growth" was undertaken to estimate as accurately as possible the population of subunits in the most densely-populated part of the project study area, which is within a 50-mile radius of the Los Angeles City Hall. In the remainder of the southern California area, the principles underlying this theory were also followed. However, the detailed computations, which were utilized in the Los Angeles area, were not made in the remainder of the area as the available statistics on population therein were not adequate to calculate a pattern based on the extension of historical development.

The concentric theory of growth is presented in the winter, 1954, volume of Journal of the American Institute of Planners, in an article entitled "The Tidal Wave of Metropolitan Expansion", by Hans Blumenfeld. This theory states that the population increase in a metropolitan area progresses in a wave-like manner from the center to the periphery. Each concentric area is postulated as experiencing succeeding phases of relatively slow growth, sustained rapid growth, gradual leveling off and then a slight decrease. The theory further states that future density-distance-time relationships can be predicted if a historical period of sufficient length is analyzed.

Using the example outlined by Mr. Blumenfeld, the patterns of changing densities in the Los Angeles area were evaluated at 10-year intervals in the period of time from 1900 to 1950, and 1957. The 50-mile radius around the Los Angeles City Hall includes most of Los Angeles and Orange Counties, and a large portion of coastal San Bernardino and Riverside Counties. That portion of Ventura County which is within this 50-mile radius was not included, due to the scarcity of detailed historical population data for that area.

Township areas and census tracts were divided into concentric zones, radiating from the Los Angeles City Hall, each two miles wide. Historical populations in the townships and census tracts, obtained from Bureau of the Census publications, were divided into these concentric zones by assuming that equal densities existed throughout each tract. Bodies of water and rugged mountainous lands were not included in the zonal areas. The resulting historical distribution is tabulated on Table 18 by distance zones, together with the net habitable area of each zone. In this table, adjustments have been made in some distance zones to correct for the effects of the limited access to Los Angeles from areas isolated therefrom by mountain ranges, such as the Antelope Valley. For these areas, highway distances were considered rather than air distances and the distances connected with the effected zones were adjusted accordingly.

TABLE 18

POPULATION DISTRIBUTION IN THE LOS ANGELES AREA BY TWO-MILE CONCENTRIC ZONES CENTERED ON THE LOS ANGELES CITY HALL

Distance zone (miles)	Net habitable area (square miles)	Population in thousands						
		Years						
		1900	1910	1920	1930	1940	1950	1957
0- 2	14.62	10.2	31.3	56.9	126	150	197	168
2- 4	34.23	19.6	60.1	110	238	289	380	339
4- 6	49.48	17.3	54.2	103	255	315	405	444
6- 8	79.21	25.0	77.4	144	362	455	626	686
8-10	109.8	28.6	84.4	144	322	415	584	697
10-12	128.6	12.5	34.9	63.7	170	237	419	637
12-14	141.1	17.4	48.8	94.8	206	270	406	555
14-16	167.8	9.51	26.6	52.2	118	163	272	555
16-18	159.1	7.50	19.5	36.8	92.9	122	226	376
18-20	213.8	8.89	16.1	55.6	136	171	277	388
20-22	225.9	7.90	24.8	48.1	107	133	205	278
22-24	216.7	2.63	7.90	16.7	38.6	47.1	72.8	233
24-26	168.4	2.65	4.66	8.83	18.9	20.4	31.3	205
26-28	207.1	0.92	2.39	3.80	6.82	13.0	25.7	118
28-30	201.6	8.59	16.0	22.5	36.2	40.6	62.0	94.1
30-32	189.6	6.43	13.2	22.4	44.8	49.0	73.4	123
32-34	102.4	1.36	1.86	2.65	4.08	5.41	8.87	20.9
34-36	105.6	3.27	7.85	12.6	20.6	26.7	48.3	88.6
36-38	116.0	1.03	1.65	2.46	3.18	4.22	7.10	14.1
38-40	117.3	0.83	1.47	2.33	2.84	3.44	6.98	11.5
40-42	124.7	2.71	4.71	6.82	9.20	12.0	15.4	22.3
42-44	123.6	0.64	1.12	2.00	2.25	2.91	5.89	9.56
44-46	124.2	0.53	0.92	1.64	3.86	6.90	11.2	16.4
46-48	123.3	0.45	0.75	1.43	4.80	6.19	17.0	20.0
48-50	123.6	0.40	0.68	1.24	1.43	1.86	3.15	6.40
TOTALS	3,367.74	196.84	543.26	1,016.50	2,330.46	2,959.73	4,386.09	6,106.86

Source of Data:		
	1900-1950	U. S. Bureau of the Census publications.
	1957	Planning Commissions of Los Angeles, Orange, San Bernardino, and Riverside Counties.

Densities of each concentric zone were calculated for each decade from 1900 to 1950, and for 1957. In addition, ten-mile moving averages were taken of the data and densities were calculated on this basis as shown on Table 19. The ten-mile moving average density of each zone for each period of time was then related to the average density of the entire concentric area for the corresponding time period. These values of zonal densities, expressed as percentages of the total area density, are tabulated in Table 20, and shown on Figures 11 and 12, respectively, as a function of distance of concentric zones from Los Angeles City Hall, by years; and as a function of time, by distances.

As these figures demonstrate, population distribution in the Los Angeles area is slowly approaching homogeneity, with the curves representing the densities in later years trending towards the 100 per cent line, which represents uniform density conditions over the entire area. This pattern is indicative of the strong tendency for urban growth to fill the low density areas closer in to the center prior to strengthening the outlying areas close to the periphery.

TABLE 19

TEN-MILE MOVING AVERAGES OF POPULATION AREAS AND POPULATION DENSITIES IN THE LOS ANGELES AREA

Distance zone (miles)	Average population* (in thousands of persons)							Average net habitable area* (in square miles)	Average population density* (in persons per square mile)						
	Years								Years						
	1900	1910	1920	1930	1940	1950	1957		1900	1910	1920	1930	1940	1950	1957
4- 6	20.1	61.5	111.8	261	325	438	447	58	350	1,070	1,940	4,540	5,650	7,630	7,770
6- 8	20.6	62.2	113.1	269	342	483	540	80	256	775	1,410	3,360	4,260	6,020	6,730
8-10	20.1	60.0	110.2	263	338	488	584	102	208	590	1,080	2,590	3,330	4,800	5,740
10-12	18.6	54.4	99.9	236	308	461	606	125	148	434	798	1,880	2,460	3,680	4,840
12-14	15.1	42.8	78.4	182	241	381	564	141	107	303	555	1,290	1,710	2,700	3,990
14-16	11.2	29.2	60.6	145	193	320	502	162	68.8	180	374	893	1,190	1,970	3,100
16-18	10.2	27.2	57.5	132	172	277	430	182	56.4	150	317	727	946	1,530	2,370
18-20	7.29	19.0	41.9	98.6	127	211	366	197	37.1	96.5	213	501	647	1,070	1,860
20-22	5.91	14.6	33.2	78.6	98.6	162	296	197	30.0	74.2	169	399	501	826	1,500
22-24	4.60	11.2	26.6	61.4	76.9	122	244	206	22.3	54.2	129	298	373	593	1,180
24-26	4.54	11.2	20.0	41.4	50.8	79.4	185	204	22.3	54.7	98.0	203	249	389	909
26-28	4.24	8.83	14.9	29.0	34.0	53.0	155	197	21.6	44.9	75.5	148	173	270	785
28-30	3.99	7.62	12.0	22.1	25.7	40.3	112	174	23.0	43.8	69.3	127	148	232	645
30-32	4.12	8.26	12.8	22.5	27.0	43.7	88.8	161	25.5	51.2	79.3	139	167	271	551
32-34	4.13	8.11	12.5	21.8	25.2	39.9	68.2	143	28.9	56.7	87.5	152	176	279	476
34-36	2.59	5.20	8.49	15.1	17.8	28.9	51.6	126	20.5	41.2	67.3	120	141	229	409
36-38	1.84	3.51	5.36	7.98	10.4	17.3	31.5	113	16.2	31.0	47.3	70.5	91.4	153	278
38-40	1.70	3.36	5.23	7.62	9.85	16.7	29.2	117	14.5	28.6	44.5	64.9	83.9	142	249
40-42	1.15	1.97	3.05	4.27	5.88	9.3	14.8	121	9.5	16.2	25.2	35.2	48.5	77	122
42-44	1.03	1.79	2.84	4.59	6.28	11.3	16.2	123	8.4	14.6	23.2	37.4	51.2	92	132
44-46	0.94	1.63	2.62	4.31	5.96	10.5	15.1	124	7.6	13.2	21.2	34.8	48.1	85	122
46-48	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
48-50	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Average density									58.4	161.2	302	692	879	1,302	1,813

*All values are calculated for ten-mile moving averages for two-mile distance zones.

TABLE 20

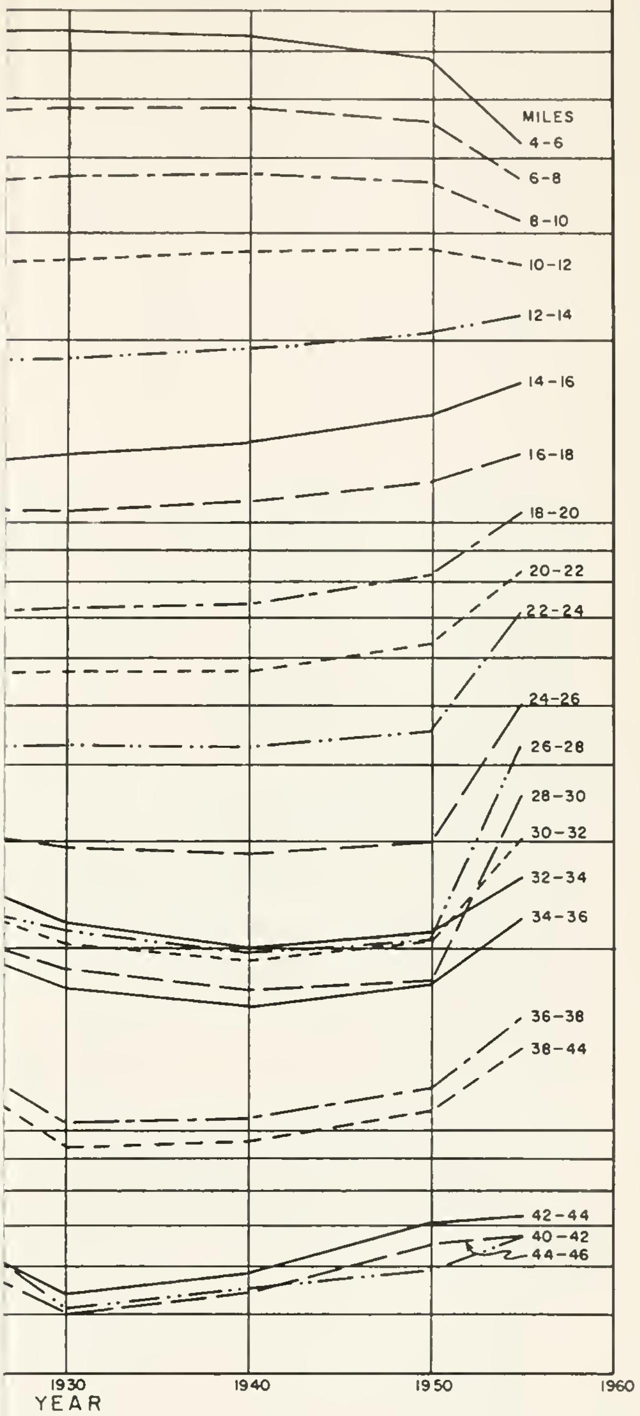
HISTORICAL AND PROJECTED RELATIVE DENSITIES OF DISTANCE ZONES IN THE LOS ANGELES AREA

Distance zone (miles)	Distance zone density as a per cent of average of total area density													
	Historical[a]							Projected[b]						
	1900	1910	1920	1930	1940	1950	1957	1960	1970	1980	1990	2000	2010	2020
0- 2								410	330	270	230	220	200	180
2- 4								390	320	260	230	220	200	190
4- 6	600	600	640	660	640	590	430	360	310	260	230	210	190	180
6- 8	440	480	470	480	480	460	370	330	290	250	220	200	190	180
8-10	360	370	360	370	380	370	320	300	270	240	210	190	180	170
10-12	260	270	260	270	280	280	270	270	250	220	200	180	170	160
12-14	180	190	180	190	190	200	220	240	220	200	190	170	160	150
14-16	120	110	120	130	140	150	170	200	200	190	180	160	150	140
16-18	97	93	100	100	110	120	130	170	180	170	160	150	140	140
18-20	64	60	70	72	74	82	100	140	150	150	150	140	130	130
20-22	51	46	56	58	58	63	83	100	120	130	130	130	120	120
22-24	38	34	43	43	42	46	65	76	92	110	110	120	110	110
24-26	38	34	33	29	28	30	50	56	69	84	96	100	100	99
26-28	37	28	25	20	20	21	43	41	51	64	79	88	92	93
28-30	39	27	23	18	17	18	36	31	39	49	62	73	81	83
30-32	44	32	26	20	19	21	30	24	30	39	49	61	69	76
32-34	50	35	29	22	20	21	26	19	24	31	40	50	59	70
34-36	35	26	22	17	16	18	23	16	20	25	33	42	51	63
36-38	28	19	16	10	10	12	15	13	17	21	28	36	45	57
38-40	25	18	15	9.4	9.5	11	14	11	14	18	24	32	40	55
40-42	16	10	8.3	5.1	5.5	5.9	6.2	9.9	13	16	21	28	36	49
42-44	14	9.1	7.7	5.4	5.8	7.1	7.3	8.7	11	14	19	26	34	46
44-46	13	8.2	7.0	5.0	5.5	6.5	6.7	7.8	10	13	18	24	32	43
46-48								7.3	9.7	12	17	22	31	42
48-50								6.8	9.2	12	17	22	30	40

a. Historical data based on ten-mile moving average densities for each distance zone.

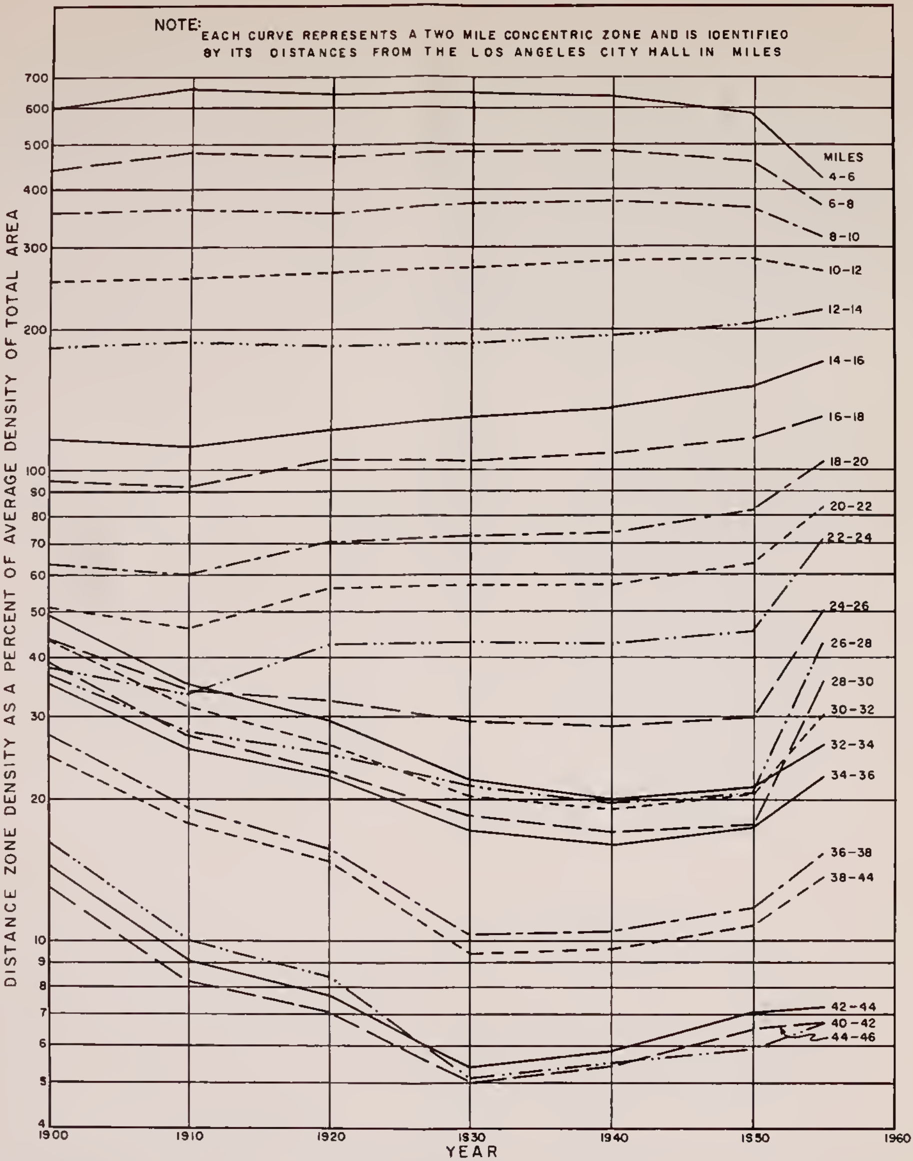
b. Projected values for distance zones 0-2, 2-4, 46-48, and 48-50 were obtained from graphic extrapolations of values for adjacent zones.

TWO MILE CONCENTRIC ZONE AND IS IDENTIFIED
THE LOS ANGELES CITY HALL IN MILES



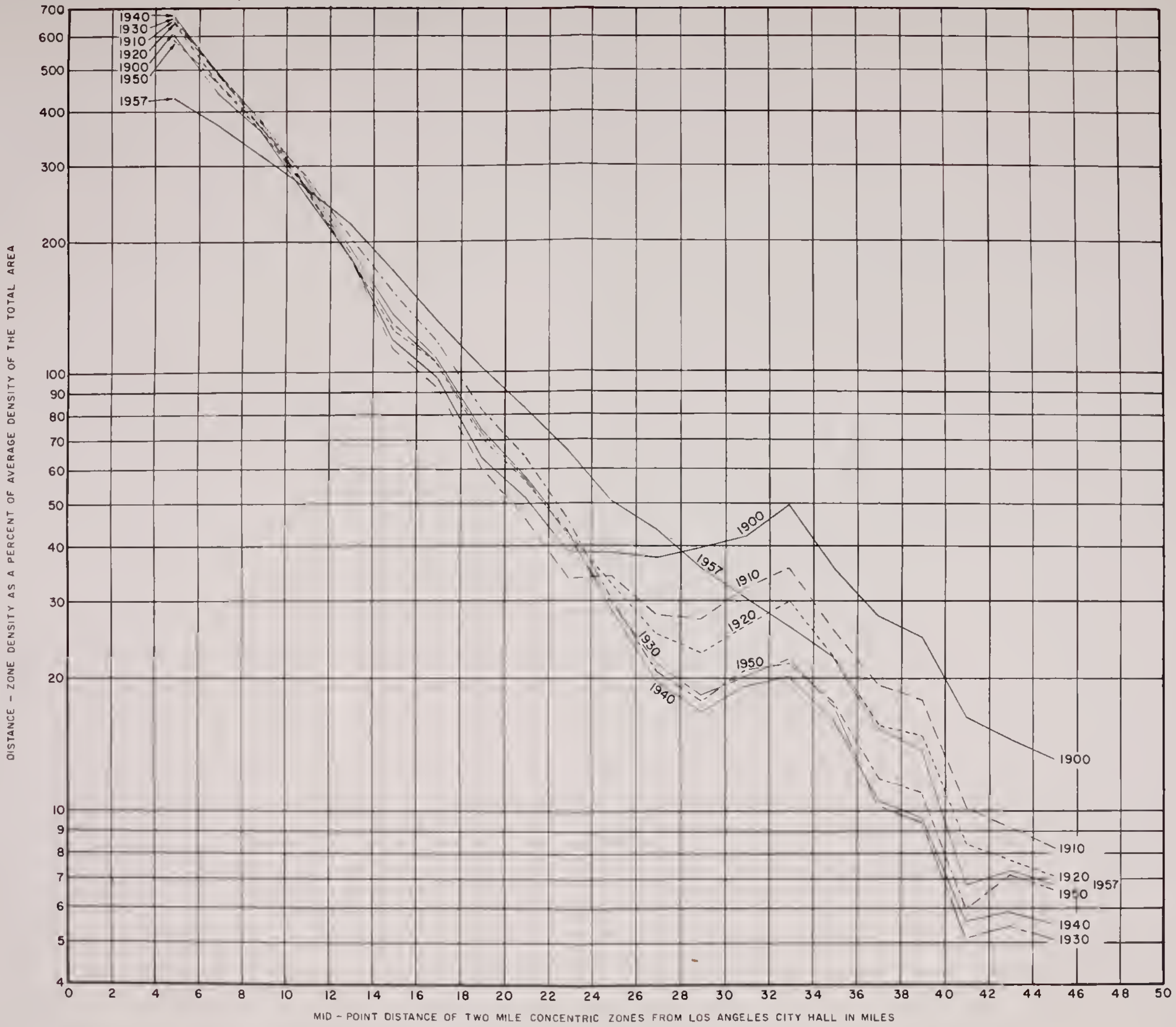
BUTION OF POPULATION DENSITY
ES AREA BY DECADE
OF DISTANCE ZONE

FIGURE 11



HISTORICAL RELATIVE DISTRIBUTION OF POPULATION DENSITY
IN THE LOS ANGELES AREA BY DECADE
AS A FUNCTION OF DISTANCE ZONE

FIGURE 12



HISTORICAL RELATIVE DISTRIBUTION OF POPULATION DENSITY IN THE LOS ANGELES AREA BY DISTANCE ZONES AS A FUNCTION OF TIME

DEPARTMENT OF WATER RESOURCES

The relative density-distance-time relationships plotted on Figure 11 show a relative density decrease in the inner zones and corresponding rises in the outer areas with the passage of time. As each of the inner zones approaches conditions of saturation, its relative density begins to drop. It was also noted that each zone, beginning with the innermost, reaches its peak relative density in successive years in a rhythmic pattern. However, even though each zone followed a similar trend, the extreme inner and outer zones exhibited sharper rates of change than the remainder of the zones.

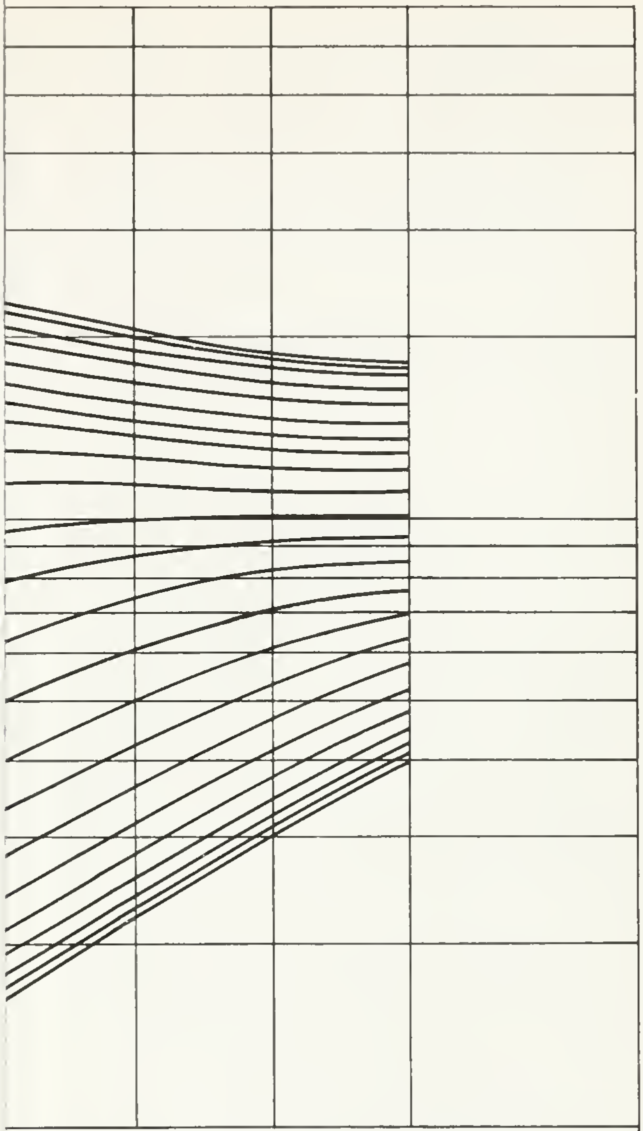
The conclusions realized through analyses of Figures 11 and 12 substantiated the theories advanced by Mr. Blumenfeld for developing patterns of future population distribution in urban areas. Using these theories of metropolitan area population distribution, the relationships portrayed in Figure 11 were generalized for the total area for the period from 1850 to the year 2020. This idealized projection of population distribution is shown on Figure 13. Relative densities for each zone were taken from this graph and tabulated in Table 20, along with historical data. These projected densities formed the basis for estimating the future populations of subunits within the Los Angeles area and, as such, all the conclusions derived from historical data were incorporated in their construction.

However, prior to projecting population, it was necessary to first estimate the future average yearly density. This was accomplished by (1) determining the area's average density under the median population projection for the year 2020, and (2) graphically extending the historical curve of average density to this point on the basis of the area's historical trend in average density. Historical and projected population densities for the Los Angeles area are tabulated below:

Year	Historical average density in persons per square mile	Year	Projected average density in persons per square mile
1900	58.4	1960	2,090
1910	161	1970	2,670
1920	302	1980	3,180
1930	692	1990	3,700
1940	879	2000	4,100
1950	1,300	2010	4,570
1957	1,810	2020	4,900

In deriving these projections of average density, many studies of historical density patterns were obtained and reviewed. These studies covered metropolitan areas from New York to San Francisco, as well as many southern California communities.

Table 21 contains a tabulation of the forecast densities of each distance zone, obtained by multiplying the projected average density by the prior projection of the relative density of each zone. Through multiplying these forecast densities by the net habitable area in each zone, the projections of population shown on Table 22 were obtained. These projections were used in estimating future populations and water requirements for the investigational subunits within the 50-mile radius around the Los Angeles City Hall. The values for the distance zones which were previously eliminated in determining 10-mile moving averages were obtained through inspection of the characteristics of growth of adjacent zones.



NOTES

RE GRAPHICAL REPRESENTATION OF CONCENTRIC THEORY
'H, WITH HISTORICAL DATA CONVERTED TO IDEALIZED
SHIP.

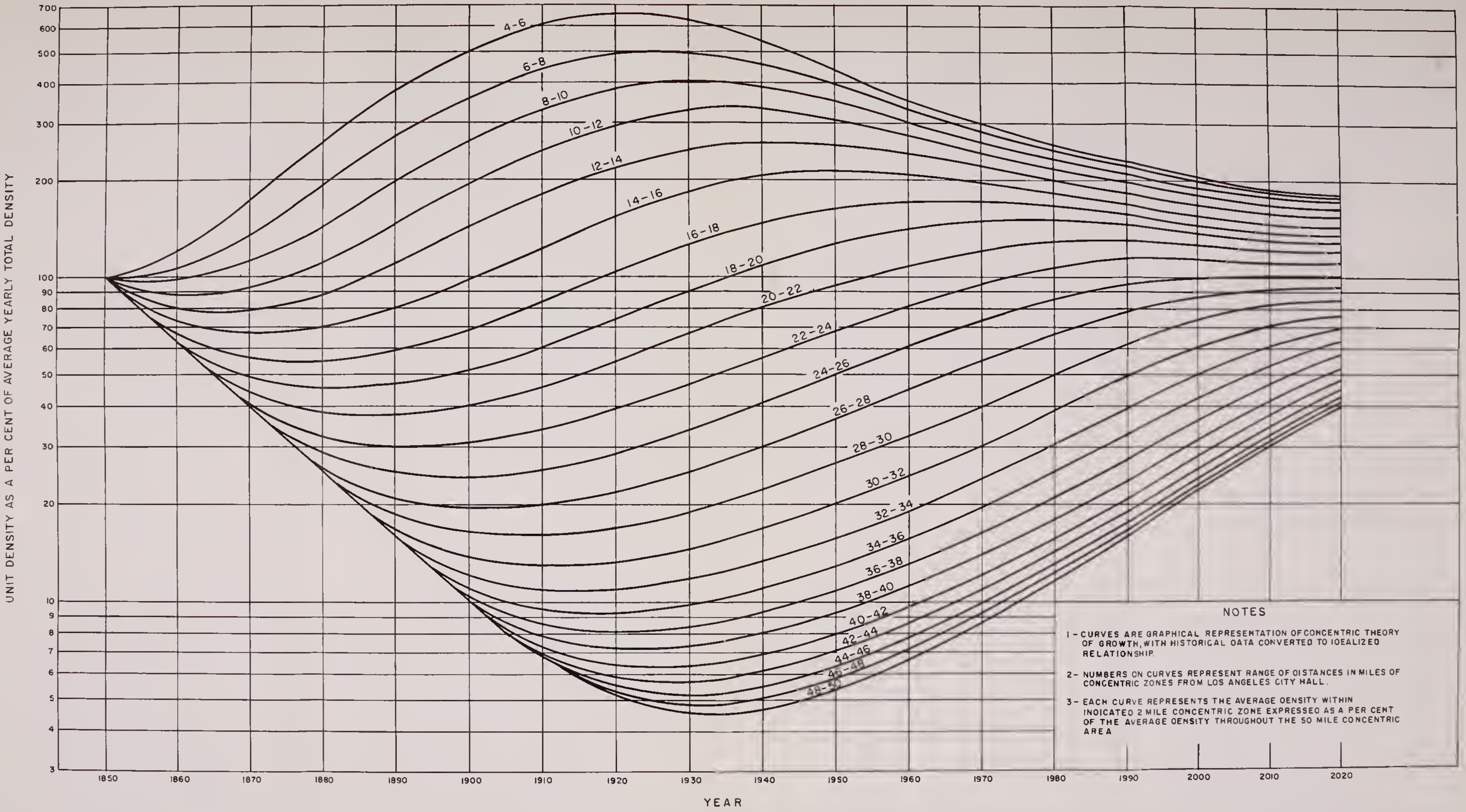
ON CURVES REPRESENT RANGE OF DISTANCES IN MILES OF
IC ZONES FROM LOS ANGELES CITY HALL.

VE REPRESENTS THE AVERAGE DENSITY WITHIN
) 2 MILE CONCENTRIC ZONE EXPRESSED AS A PER CENT
VERAGE DENSITY THROUGHOUT THE 50 MILE CONCENTRIC

90 2000 2010 2020

S AREA

FIGURE 13



NOTES

1 - CURVES ARE GRAPHICAL REPRESENTATION OF CONCENTRIC THEORY OF GROWTH, WITH HISTORICAL DATA CONVERTED TO IDEALIZED RELATIONSHIP.

2 - NUMBERS ON CURVES REPRESENT RANGE OF DISTANCES IN MILES OF CONCENTRIC ZONES FROM LOS ANGELES CITY HALL.

3 - EACH CURVE REPRESENTS THE AVERAGE DENSITY WITHIN INDICATED 2 MILE CONCENTRIC ZONE EXPRESSED AS A PER CENT OF THE AVERAGE DENSITY THROUGHOUT THE 50 MILE CONCENTRIC AREA

RELATIONSHIPS BETWEEN POPULATION DENSITY, DISTANCE, AND TIME IN THE LOS ANGELES AREA

TABLE 21

PROJECTED POPULATION DENSITIES OF DISTANCE ZONES IN THE LOS ANGELES AREA

Distance zone (miles)	Population density in persons per square mile						
	Years						
	1960	1970	1980	1990	2000	2010	2020
0- 2	8,550	8,700	8,650	8,660	9,000	8,980	8,960
2- 4	8,080	8,590	8,320	8,580	8,910	8,920	9,020
4- 6	7,600	8,180	8,130	8,420	8,600	8,720	8,800
6- 8	7,030	7,680	7,870	8,190	8,320	8,520	8,580
8-10	6,365	7,140	7,520	7,800	8,010	8,210	8,250
10-12	5,700	6,600	7,100	7,410	7,560	7,850	7,920
12-14	5,000	5,970	6,660	7,020	7,110	7,450	7,540
14-16	4,275	5,360	6,060	6,590	6,660	7,040	7,150
16-18	3,540	4,690	5,440	6,000	6,160	6,630	6,710
18-20	2,850	3,950	4,800	5,460	5,760	6,220	6,220
20-22	2,150	3,190	4,100	4,880	5,260	5,710	5,720
22-24	1,600	2,450	3,390	4,210	4,770	5,200	5,280
24-26	1,170	1,840	2,690	3,550	4,280	4,690	4,840
26-28	855	1,360	2,050	2,920	3,620	4,230	4,560
28-30	656	1,040	1,570	2,300	3,000	3,700	4,070
30-32	508	816	1,230	1,830	2,520	3,160	3,740
32-34	407	650	979	1,470	2,070	2,680	3,410
34-36	331	530	800	1,210	1,730	2,320	3,080
36-38	277	446	672	1,020	1,480	2,040	2,800
38-40	238	385	576	885	1,300	1,820	2,700
40-42	207	339	506	780	1,150	1,670	2,390
42-44	182	303	459	706	1,050	1,560	2,260
44-46	163	275	416	659	968	1,460	2,120
46-48	152	258	400	632	914	1,400	2,040
48-50	142	245	390	624	896	1,380	1,980

TABLE 21

PROJECTED POPULATION DENSITIES OF DISTANCE ZONES IN THE LOS ANGELES AREA

Distance zone (miles)	Population density in persons per square mile						
	Years						
	1960	1970	1980	1990	2000	2010	2020
0- 2	8,550	8,700	8,650	8,660	9,000	8,980	8,960
2- 4	8,080	8,590	8,320	8,580	8,910	8,920	9,020
4- 6	7,600	8,180	8,130	8,420	8,600	8,720	8,800
6- 8	7,030	7,680	7,870	8,190	8,320	8,520	8,580
8-10	6,365	7,140	7,520	7,800	8,010	8,210	8,250
10-12	5,700	6,600	7,100	7,410	7,560	7,850	7,920
12-14	5,000	5,970	6,660	7,020	7,110	7,450	7,540
14-16	4,275	5,360	6,060	6,590	6,660	7,040	7,150
16-18	3,540	4,690	5,440	6,000	6,160	6,630	6,710
18-20	2,850	3,950	4,800	5,460	5,760	6,220	6,220
20-22	2,150	3,190	4,100	4,880	5,260	5,710	5,720
22-24	1,600	2,450	3,390	4,210	4,770	5,200	5,280
24-26	1,170	1,840	2,690	3,550	4,280	4,690	4,840
26-28	855	1,360	2,050	2,920	3,620	4,230	4,560
28-30	656	1,040	1,570	2,300	3,000	3,700	4,070
30-32	508	816	1,230	1,830	2,520	3,160	3,740
32-34	407	650	979	1,470	2,070	2,680	3,410
34-36	331	530	800	1,210	1,730	2,320	3,080
36-38	277	446	672	1,020	1,480	2,040	2,800
38-40	238	385	576	885	1,300	1,820	2,700
40-42	207	339	506	780	1,150	1,670	2,390
42-44	182	303	459	706	1,050	1,560	2,260
44-46	163	275	416	659	968	1,460	2,120
46-48	152	258	400	632	914	1,400	2,040
48-50	142	245	390	624	896	1,380	1,980

TABLE 22

PROJECTED DISTRIBUTION OF POPULATION IN THE LOS ANGELES AREA BY DISTANCE ZONES

Distance zone (miles)	Population in thousands						
	Years						
	1960	1970	1980	1990	2000	2010	2020
0- 2	125	132	122	127	132	130	131
2- 4	276	294	285	294	305	305	309
4- 6	376	405	402	417	426	432	435
6- 8	557	608	623	649	659	675	680
8-10	699	784	826	856	880	902	906
10-12	733	849	913	953	972	1,010	1,020
12-14	706	842	940	990	1,000	1,050	1,060
14-16	717	899	1,020	1,106	1,120	1,180	1,200
16-18	563	746	866	955	980	1,050	1,070
18-20	609	844	1,030	1,180	1,230	1,330	1,330
20-22	486	721	926	1,100	1,190	1,290	1,290
22-24	347	531	735	912	1,030	1,130	1,140
24-26	197	310	453	598	721	790	815
26-28	177	282	425	605	750	876	944
28-30	132	210	316	464	605	746	820
30-32	96.3	155	233	347	478	599	709
32-34	41.7	66.6	100	150	212	274	349
34-36	35.0	56.0	84.5	128	183	245	325
36-38	32.1	51.7	78.0	118	172	237	325
38-40	27.9	45.2	67.6	104	152	214	317
40-42	25.8	42.3	63.1	97.3	143	208	298
42-44	22.5	37.4	56.1	87.3	130	193	279
44-46	20.2	34.2	51.7	81.8	120	181	263
46-48	18.7	31.8	49.3	77.9	113	173	252
48-50	17.6	30.3	48.2	77.1	111	171	245
TOTALS	7,037.8	9,006.9	10,713.5	12,474.4	13,818	15,391	16,512

The curves resulting from the application of the concentric theory of growth to the Los Angeles area portray the exploding outward growth of the Los Angeles metropolitan complex, with the growth occurring in concentric waves. The density-distance-time relationships show that the spectacular population mushrooming of such cities as West Covina, from a population of 4,500 in 1950 to 8,100 persons 20 months later and 38,000 in 1957; and Anaheim, which increased from 14,600 in 1950 to 47,000 persons in 1956; are compatible with the Los Angeles area's past 60 years of growth when these cities are considered as a part of the entire metropolitan complex.

As stated, the future populations in subunits outside of the 50-mile radius from the Los Angeles City Hall were estimated by applying the same factors of varying urban densities, location, and time to available habitable lands. In these areas the future patterns of density were derived through analysis of historical growth patterns and resulting anticipated changes therein. To aid in developing the distribution of the county population estimates, county and city planning commissions and local governmental and private organizations were contacted throughout the investigational area. The patterns of relative growth of subunits in terms of urban densities used were balanced against the total county population derived from the regional population projection.

Urban Land Requirements

Residential, commercial, industrial, and municipal demand for land historically has received a higher priority for available land than have agricultural demands. This pattern was assumed to continue throughout the study period. The urban demands for land in each subunit have been calculated by adding to present urban land areas the acreage of land required for further urbanization as determined by applying projections of urban densities to the projected populations of each subunit. Urban densities for each subunit were estimated for present conditions, based upon present land use surveys and estimates of present populations. Through analyzing these densities existing under various local conditions and representing different stages of development of communities, trends in densities for subunits outside the 50-mile radius around the Los Angeles City Hall were projected. This was done by comparing each subunit with communities whose present levels of development and local conditions are similar to the anticipated subunit development.

In the areas estimated to become the most densely populated in southern California, which consist of portions of the Los Angeles coastal plain, the density was estimated to be about 18 persons per acre by 1980. This value may be compared to a present density in the City of New York of 38.5 persons per acre and in San Francisco of 27.7 persons per acre. Thus, it may be noted that even with saturated conditions, population densities in southern California are predicted to be substantially less than now exist in highly developed urban centers.

The urban demand for lands in various areas in southern California which result from application of the projected densities to the projected populations are shown by decades in Table 23.

TABLE 23

HISTORICAL AND PROJECTED URBAN LAND REQUIREMENTS

(Values in acres)

Region	1950	1957	1960	1970	1980	1990	2000	2010	2020
San Luis Obispo Service Area[a]	4,800	---	17,300	19,700	22,700	29,500	42,700	57,600	74,400
Santa Barbara Service Area	8,200	12,800	17,000	23,600	32,400	44,700	63,900	87,600	118,200
Ventura County	25,000	26,400	29,200	38,300	50,100	68,800	102,600	131,500	157,900
Coastal Los Angeles County	385,000	457,900[b]	723,000	894,500	986,700	1,024,500	1,031,900	1,038,300	1,043,800
Orange County	28,000	69,200	81,600	141,300	193,700	230,700	253,400	263,100	268,100
Coastal San Diego County[a]	51,600	70,800[c]	78,500	121,400	168,400	218,900	271,200	311,700	350,000
Coastal Riverside County	23,300	29,200	29,700	41,800	63,100	94,600	135,600	174,300	201,100
Coastal San Bernardino County	34,500	53,600	69,500	95,900	124,700	161,500	192,200	224,500	248,600
Kern County Service Area	16,100	26,300[c]	28,000	44,400	53,400	63,700	81,800	107,000	136,700
Antelope-Mojave Service Area[a]	3,900	12,400	22,400	45,200	98,100	158,400	215,600	256,700	292,300
Whitewater-Coachella Service Area[a]	4,200	10,600[c]	12,200	18,600	26,500	38,000	53,500	68,300	79,100

a. Urban land requirements do not include requirements for military lands in these areas.
b. 1955 acreage.
c. 1958 acreage.

Usually, urban demands for land will be satisfied first by the use of the most desirable agricultural lands in any area. Accordingly, the lands available for agricultural usage were calculated by subtracting the required urban acreages from the total irrigable and habitable lands, taking the most desirable lands first. The balance of the irrigable lands were then considered as land available for use by agriculture.

Economic Development

In California, as in other areas, net in-migration, population growth, and economic expansion are interdependent. Intermittently in the past, the State's population has momentarily surged ahead of employment opportunity. However, considering the last 50 years as a whole, California's population growth has been accompanied by a related increase in economic activity and employment. As a necessary phase in accurately estimating the levels of in-migration to California and to aid in evaluating the reasonableness of the statistical projections of the State's population, the probable future economic activity in the State and southern California was studied. These studies enabled relationships to be derived between economic activity, employment, and population.

Employment was used as the primary indicator of economic activity for the following reasons:

(1) Employment data are more readily available, cover longer time periods, are available for more recent dates, and more reliable than other types of economic data.

(2) Employment data are more directly related to population data than other indicators of economic activity.

(3) Employment data are not affected by changes in the values of the dollar.

All employment data and projections presented herein represent average employment of civilian workers for the indicated year. Hence, these data for 1940 and 1950 differ from the civilian employment figures reported by the 1940 and 1950 Census of Population for the United States and California, which are for civilian employment as of April 1 of those years.

Average annual employment figures were used for the analyses and projections because:

(1) Data comparable to the April 1 employment figures from the Census of Population are not available for intercensal years. It therefore was desirable to use average annual employment data for analysis of trends of change in employment patterns of the United States and California since 1950 and for projections of these future employment patterns.

(2) All population projections are for July 1 of the indicated future years and projections of average annual employment are preferable for relating future levels of population and employment.

(3) Average employment for the year eliminates the effect of seasonal variations, which is especially important in California due to dependence on manufacturing employment and agricultural employment.

In developing future national economic and employment patterns to serve as a framework for projections of California's economy, recent projections of the national economy and industrial employment by sectors of the economy made by the Stanford Research Institute* and the University of Pennsylvania** were obtained and reviewed. These national projections of employment were revised to place them on the same basis as the later national population studies herein reported and a composite projection of national employment by major categories was developed, based on the projections contained in these two studies. Table 24 shows a summary of this projection to 1980, together with historical data. Several trends are in evidence in this table, of which the primary ones are the continued decline of agricultural and mining employment as a per cent of total; the gradual increase, in per cent of total, of manufacturing employment to a peak in 1970, and then a subsequent slight decline; and the continued rise in governmental employment throughout this period of time. A more detailed tabulation of historical and projected national employment is contained in Table No. 93, Attachment No. 10.

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* "Production Trends in the United States through 1975", by Bonnar Brown and M. Janet Hansen, Stanford Research Institute.

** "Industrial Land and Facilities for Philadelphia", by the Institute for Urban Studies, University of Pennsylvania.

TABLE 24

HISTORICAL AND PROJECTED EMPLOYMENT IN UNITED STATES

(Civilian employment in thousands)

Employment sectors	1940		1950		1956		1970		1980	
	Employment	Per cent of total employment	Employment	Per cent of total employment	Employment	Per cent of total employment	Employment	Per cent of total employment	Employment	Per cent of total employment
Agriculture	8,044	17.78	6,477	11.37	5,304	8.51	4,884	6.19	4,510	4.80
Mining	965	2.13	952	1.67	858	1.38	872	1.10	853	0.91
Manufacturing	11,009	24.34	15,154	26.59	17,120	27.47	22,559	28.60	26,454	28.16
Subtotals	20,018	44.25	22,583	39.63	23,282	37.36	28,315	35.89	31,817	33.87
Construction	1,941	4.30	3,370	5.91	3,955	6.35	5,282	6.70	6,560	6.98
Transportation, trade, finance, and service	19,357	42.79	25,359	44.50	28,734	46.11	35,136	44.54	42,545	45.29
Government[a]	3,918	8.66	5,674	9.96	6,343	10.18	10,150	12.87	13,017	13.86
Subtotals	23,275	51.45	31,033	54.46	35,077	56.29	45,286	57.41	55,562	59.15
TOTALS	45,234	100.00	56,986	100.00	62,314	100.00	78,883	100.00	93,939	100.00

a. Excludes Military Personnel.

Note: Source of historical data: Table 28 in United States Department of Commerce, Office of Business Economics Publications (1) "National Income 1954 Edition" (2) "Survey of Current Business, July, 1957".

Employment in California

Data on historical California employment by industry sectors were compiled from publications of the California Departments of Employment and Industrial Relations and compared to national employment in the respective categories. These data are shown in summary form in Table 25 and in more detail in Table 94, Attachment No. 10. In comparing the historical trends in California employment with national employment, a few differences in trends of per cent employment by category were observed. In California, employment in the commercial categories of transportation, trade, finance, and service employment have been declining while increasing nationally. Also, the manufacturing employment increase in California has been considerably greater than the national increase in this category.

This growth in California manufacturing employment was emphasized in a series of studies prepared by the United States Department of Commerce, Office of Area Development, and entitled "Industry Trend Series". These studies compiled data on those subgroups of manufacturing in which employment increased at least 30 per cent between 1947 and 1954. Some 106 individual industry classes were so identified. For 69 of these same industry classes, sufficient data were compiled so that comparisons could be made between California's and the nation's growth rates. These comparisons are shown on Figure 14 in a frequency distribution curve, which shows, by the percentage of the 69 industry classes, the change in California employment as compared to the change in United States employment.

TABLE 25

HISTORICAL EMPLOYMENT IN CALIFORNIA

(Civilian employment in thousands)

Employment sectors	1940			1950			1956		
	Employment	Per cent of total employment	Per cent of U. S. employment by group	Employment	Per cent of total employment	Per cent of U. S. employment by group	Employment	Per cent of total employment	Per cent of U. S. employment by group
Agriculture	317	11.73	3.94	424	10.09	6.54	490	8.92	9.24
Mining	46	1.70	4.77	35	0.83	3.67	41	0.75	4.78
Manufacturing	461	17.05	4.19	797	18.97	5.26	1,246	22.68	7.28
Subtotals	824	30.48	4.12	1,256	29.98	5.56	1,777	32.35	7.63
Construction	128	4.74	6.59	289	6.88	8.58	372	6.77	9.41
Transportation, trade, finance, and service	1,485	54.94	7.67	2,124	50.55	8.38	2,638	48.01	9.18
Government	266	9.84	6.79	533	12.68	9.39	707	12.87	11.15
Subtotals	1,751	64.78	7.52	2,657	63.23	8.56	3,345	60.88	9.54
TOTALS	2,703	100.00	5.98	4,202	100.00	7.37	5,494	100.00	8.82

Notes: (1) Source of data: State of California, Department of Industrial Relations, Division of Labor Statistics and Research. "Handbook of California Labor Statistics 1955-1956."

(2) For comparison, the per cent of U. S. population in California for indicated years was as follows: 1940, 5.25 per cent; 1950, 7.0 per cent; 1956, 8.56 per cent.

The peak, or median point, on the curve shows that in one-half of these growth industries, California employment has been increasing at a rate 25 per cent faster than has national employment in these industries, with the average California employment increase, as shown on the figure, being 55 per cent greater than national increase. This historical record of manufacturing growth potential in California was employed in an extensive study of potential for employment growth in California by specific industry sectors.

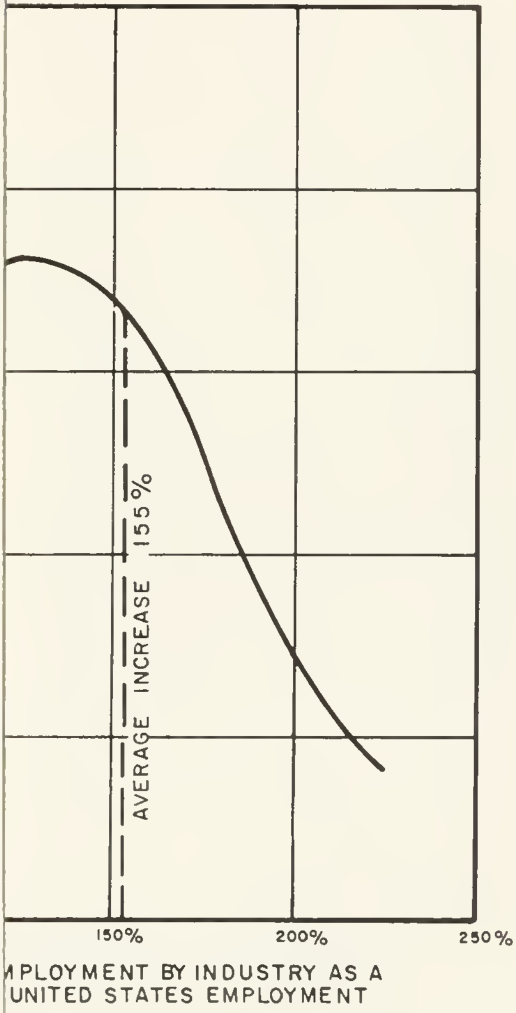
Underlying the employment projections were all the assumptions outlined earlier in this chapter which influence both the general level of economic activity and future trends in the components of the total. Specific manufacturing industries, as categorized in the standard industrial classification, were also studied with the probable outlook of each being summarized into an over-all manufacturing group projection. In certain industries, both in the commercial and in the manufacturing categories, the level of employment therein is closely associated with the State's population. In these groups, the general trend in the State's population was modified by the expected productivity changes for use in forecasting employment.

Through analyzing the potential for growth in each sector of the economy in conjunction with the opinions of California leaders in the financial, industrial, commercial, and agricultural fields, and with the historical relationships in California and United States employment, ratios of California to United States employment were developed for 1970 and 1980. These ratios

FIGURE 14

1947 TO 1954 PERIOD
59 CLASSES OF INDUSTRY

EASE IN EMPLOYMENT OF
IA INDUSTRIES INCLUDED
TER THAN AVERAGE UNITED
ASE.

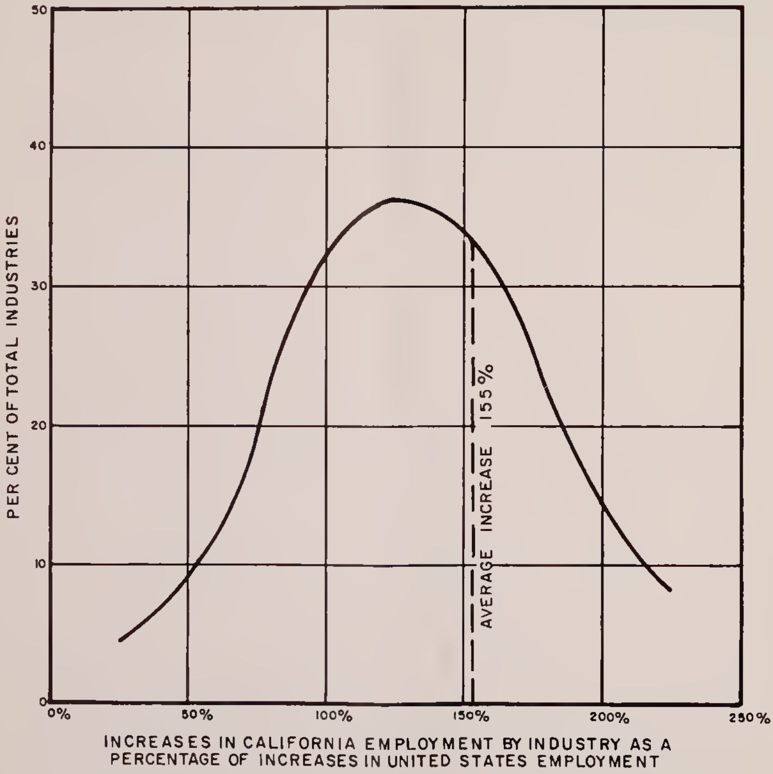


ALIFORNIA AND UNITED STATES
UFACTURING GROWTH INDUSTRIES

NOTE: DATA IS FOR 1947 TO 1954 PERIOD

THERE ARE 69 CLASSES OF INDUSTRY INCLUDED.

AVERAGE INCREASE IN EMPLOYMENT OF ALL CALIFORNIA INDUSTRIES INCLUDED IS 55% GREATER THAN AVERAGE UNITED STATES INCREASE.



COMPARISON OF CHANGES IN CALIFORNIA AND UNITED STATES EMPLOYMENT IN SELECTED MANUFACTURING GROWTH INDUSTRIES are shown in Table 26, and were applied to the projections of national employment to obtain the anticipated California employment by industry sectors also shown in Table 26. California employment in manufacturing is projected to continue its historical increase from about 1.2 million in 1958 to over 3 million in 1980. California is relatively less developed in manufacturing today than the nation but the growth projected for California manufacturing employment will almost close the gap between the State and the nation. A detailed projection of manufacturing employment by standard industrial classifications is contained in Attachment No. 10, Table No. 94.

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TABLE 26

PRESENT AND PROJECTED EMPLOYMENT IN CALIFORNIA

(Civilian employment in thousands)

Employment sectors	1958 Present		1970 Projected				1980 Projected			
	California employment	Per cent of total employment	Per cent of United States employment by group	United States employment	California employment	Per cent of total California employment	Per cent of United States employment by group	United States employment	California employment	Per cent of total California employment
Agriculture	476	8.48	10.89	4,884	532	6.37	12.10	4,510	546	4.87
Mining	36	0.64	5.16	872	45	0.54	5.86	853	50	0.45
Manufacturing	1,256	22.37	9.55	22,559	2,155	25.79	11.49	26,454	3,040	27.11
Subtotals	1,768	31.49	9.65	28,315	2,732	32.70	11.43	31,817	3,636	32.43
Construction	351	6.25	11.17	5,282	590	7.06	12.65	6,560	830	7.40
Transportation, trade, finance, and service	2,694	47.99	10.97	35,136	3,853	46.11	12.14	42,545	5,166	46.08
Government	801	14.27	11.63	10,150	1,180	14.13	12.14	13,017	1,580	14.09
Subtotals	3,495	62.26	11.11	45,286	5,033	60.24	12.14	55,562	6,746	60.17
TOTALS	5,614	100.00	10.52	78,883	8,357	100.00	11.93	93,939	11,212	100.00

Notes: (1) Source of Historical data: State of California, Department of Industrial Relations, Division of Labor Statistics and Research.

(2) For comparison, the estimated per cent of United States population in California for indicated years are as follows: 1970, 10.24 per cent; 1980, 11.37 per cent.

California Population and Employment Projections. The size of the population that would be related to the projected employment in 1970 and 1980 was derived by means of the calculations shown in the following illustration for the year 1980:

(1)	Projected California employment	11,212,000
(2)	Adjustment for multiple jobs (line 1 x 0.97)	10,876,000
(3)	Civilian labor force (line 2 ÷ 0.96)	11,329,000
(4)	Armed forces in California	250,000
(5)	Total labor force (line 3 + line 4)	11,579,000
(6)	Population over 14 years (line 5 ÷ 0.574)	20,172,000
(7)	Total population (line 6 ÷ 0.7205)	28,000,000

Line 1, projected California employment, was adjusted in line 2 to reduce the projected employment by those persons working in two or more jobs which are estimated to be three per cent of the total. The civilian labor force, line 3, is obtained by adding unemployment, projected at four per cent of the total labor force, to the adjusted employment projection. Armed forces in California are estimated to be decreased slightly from present levels which are in excess of 300,000 persons. The population over 14 years old, line 6, was obtained by dividing line 5 by the labor force participation rate, which factor relates the two items. The rate used in this study was Projection III, extrapolated to 1980, of the United States Bureau of the Census, as reported in "Current Population Reports, Labor Force", Series P-50, No. 69. Total population, line 7, was obtained by dividing line 6 by the ratio between population over 14 and total population, which ratio was obtained from the California population projection.

The California population derived in the foregoing manner from the projection of employment to 1980 is listed in the following tabulation, together with the median population projection:

	Projected California Population	
Year	Based on employment projection	Based on demographic analysis
1970	21,450,000	21,700,000
1980	28,000,000	28,200,000

Thus, the estimate of future population derived from the study of industrial employment in California closely approximates the median projection of California's population to 1980. The employment projections also indicate the expected pattern of the future economy of California.

Employment in Southern California

The future employment by major categories was projected for the nine southern California counties region using the same procedures outlined for developing estimates of California's employment. Historical data on employment by sectors of industry were difficult to obtain for southern California, making it necessary to use insured workers data from the State Department of Employment. These data were then related to total employment through ratios between insured workers and total employment which were obtained for portions of the southern California region and for the State. As in the State as a whole, the resulting estimates of total employment overstate the number of individuals due to those persons employed in more than one job. These estimates of historical employment and relationships thereof with total State employment are summarized in Table 27 and shown in detail in Attachment No. 10, Table No. 95. The most striking item evident

TABLE 27

HISTORICAL EMPLOYMENT IN THE NINE SOUTHERN CALIFORNIA COUNTIES

(Civilian employment in thousands)

Employment sectors	1940			1950			1956		
	Employment	Per cent of total employment	Per cent of California employment by group	Employment	Per cent of total employment	Per cent of California employment by group	Employment	Per cent of total employment	Per cent of California employment by group
Agriculture	110	7.40	34.7	131	6.08	26.4	142	4.35	29.0
Mining	28	1.88	60.9	26	1.21	74.3	31	0.95	75.6
Manufacturing	262	17.62	56.8	474	22.00	59.5	878	26.92	70.5
Subtotals	400	26.90	48.5	631	29.29	50.2	1,051	32.22	59.1
Construction	71	4.77	55.5	135	6.27	46.7	224	6.87	60.2
Transportation, trade, finance, and service	840	56.49	56.6	1,097	50.93	51.6	1,609	49.32	61.0
Government	176	11.84	66.2	291	13.51	54.6	378	11.59	53.5
Subtotals	1,016	68.33	58.0	1,388	64.44	52.2	1,987	60.91	59.4
TOTALS	1,487	100.00	55.0	2,154	100.00	51.3	3,262	100.00	59.4

Notes: (1) Source of historical data: State of California, Department of Industrial Relations and Department of Employment

(2) For comparison, the per cent of California population in southern California for indicated years was as follows: 1940, 54.74 per cent; 1950, 55.44 per cent; 1956, 58.05 per cent.

from Table 27 is the pre-eminent position of this region regarding manufacturing in the State, with over 70 per cent of total California employment in manufacturing being located in southern California.

The ratios between southern California and California employment by major categories were projected to the year 1980 using the studies previously described. These are summarized in Table 28 with more detail presented in Attachment No. 10, Table No. 95. The projections reflect the anticipated dispersal of manufacturing activities over the State with a consequent decrease in the percentage of manufacturing employment in southern California. However, throughout this period, the Los Angeles Metropolitan Area will continue as the dominant industrial center of California and the west. The numerical change in employment in the region is projected to increase from about 3-1/4 million in 1956 to over 6-1/2 million in 1980.

Southern California Population and Employment Projection. The regional population that would be related to the projections of employment shown in Table 28 was derived by using the same procedures and factors previously reviewed for the State, except that armed forces in the region were projected to be 160,000. The regional population derived from the projections of employment approximates that of the median population projection of the State as indicated below:

	Projected Nine Southern California Counties Population	
Year	Based on employment projection	Based on demographic analysis
1970	12,940,000	13,100,000
1980	16,640,000	16,838,000

TABLE 28

PROJECTED EMPLOYMENT IN THE NINE SOUTHERN CALIFORNIA COUNTIES

(Civilian employment in thousands)

Employment sectors	1970 Projected				1980 Projected			
	Per cent of California employment by sector	California employment	Nine Southern California Counties employment	Per cent of total regional employment	Per cent of California employment by sector	California employment	Nine Southern California Counties employment	Per cent of total regional employment
Agriculture	21.4	532	114	2.27	18.0	546	98	1.47
Mining	62.2	45	28	0.56	52.0	50	26	0.39
Manufacturing	67.8	2,155	1,460	29.01	65.8	3,040	2,000	30.06
Subtotals	58.6	2,732	1,602	31.84	58.4	3,636	2,124	31.92
Construction	61.0	590	360	7.15	58.0	830	481	7.24
Transportation, trade, finance, and service	63.0	3,853	2,427	48.23	61.8	5,166	3,195	48.02
Government	54.5	1,180	643	12.78	54.0	1,580	853	12.82
Subtotals	61.0	5,033	3,070	61.01	60.0	6,746	4,048	60.84
TOTALS	60.2	8,357	5,032	100.00	59.3	11,212	6,653	100.00

Notes: (1) Source of historical data: State of California, Department of Industrial Relations and Department of Employment.

(2) For comparison, the estimated per cent of California population in southern California for indicated years is as follows: 1970, 60.3 per cent; 1980, 59.71 per cent.

CHAPTER IV. IRRIGATED AGRICULTURAL DEVELOPMENT

The southern California area has experienced intensive development of irrigated agriculture in the past wherever water supplies have been made available. Because of favorable climatic conditions, coastal portions of the area have been able to support agriculture of a high income-producing type. The favorable conditions for continued growth of agricultural acreage in the South Coastal Area have been offset, however, by the recent extensive encroachment of urban land use on agriculture, a condition which is expected to continue in the future. Inland portions of the area, including western Kern County, the Upper Salinas Valley, and the Antelope-Mojave Service Area, have had more limited crop adaptability.

Forecasts of irrigated acreage in the southern California area have related localized climatic limitations on crops to factors of land adaptability and availability, anticipated gross and net returns by crops, costs of water to the farmer, required investments and probable returns on investments, and the general patterns of development established by precedent and environment. Since California's agricultural products are utilized throughout the nation, studies of national markets and the State's participation therein were also necessary.

A basic assumption in the studies, as outlined earlier, was that the full costs associated with delivering water to each service area should be used in projecting water demands.

Procedure

The projections of irrigated acreage were based upon an evaluation, for appropriate subunits of the investigational area, of a series of factors which exert major influences upon activity in irrigated agriculture. These factors are listed as follows:

(1) Availability and quality of land, and consideration of encroachment by urban and industrial development.

(2) Crop adaptability.

(3) Historical agricultural development patterns.

(4) Markets for farm products.

(5) Residual income available to the farmer for payment of water charges and for incentive to farm.

(6) The required investment and probable return to the investment.

(7) Cost of water, including distribution costs.

(8) Local climatic conditions.

(9) Local water development organizations.

(10) Size of farm.

The investigational work included: (1) field surveys to determine land classification and present land use; (2) personal contacts with farm advisors, county agricultural commissioners, office managers of Agricultural Stabilization and Conservation County Committees of the United States Department of Agriculture, officials of water agencies and growers' organizations, and some 150 individual farm owners and operators; (3) compilation of all available statistical data concerning historical acreages and production quantities, prices received for farm products, and production costs, including water costs from existing sources of supply. The data obtained through the investigational work were employed in evaluating the above factors and estimating the future growth of irrigated acreage.

While the most important factors used in projecting acreages of irrigated crops were the price or cost of water, residual income, and return on investment, all of the factors enumerated above were included in the analyses.

Factors Affecting the Development of Irrigated Agriculture

The factors which exert major influences upon activity in irrigated agriculture, as summarized above, are discussed in the following paragraphs, together with their effect on projections of irrigated agriculture in the southern California area.

Availability and Quality of Land

Land use in the nine southern California counties has been generally characterized in recent years by a transition from agricultural to urban uses. Thus, the evaluation of land resources in the southern California area, consisting of the detailed field surveys described in Chapter II, required further modifications before the suitable acreage available for irrigation in each subunit could be determined for future conditions. Land areas in each subunit available for irrigated agriculture were determined for the period of analysis by subtracting from the irrigable acreages obtained by field surveys the acreages required for the projected populations as summarized in Table 23 of Chapter III.

As Table 23 of Chapter III indicates, the coastal area from Ventura County to the Mexican Border is expected to experience rapid urbanization, with continued encroachment on presently irrigated lands. In coastal Los

Angeles County, irrigated agricultural lands are expected to diminish to about 5,000 acres by 1970 and to nearly disappear by about 1990. In Orange and coastal San Bernardino Counties a similar occurrence is expected, but at a slower rate, with only minor acreages remaining by the turn of the century.

In southwestern Riverside and San Diego Counties, land adaptable to high value citrus, avocados and truck crops appears to be available to the extent of 200,000 acres over and above the habitable land areas necessary to accommodate projected urban development.

In Ventura County, urban developments are expected to steadily reduce existing agricultural land areas but not to the point of complete extinction of irrigated farming. In Santa Barbara and San Luis Obispo Counties, irrigable land areas in excess of urban land requirements were found to be of sufficient magnitude to indicate that agriculture can expand. Sufficient suitable raw land is available in Kern County to permit a considerable expansion in both urban and agricultural development.

Crop Adaptability

An inventory was made of the various types of crops adapted to the climatic conditions in each of the areas studied. Because of the high value of land and competition therefor in many portions of southern California, continued existence of agriculture is dependent upon production of only the highest value crops adaptable to the particular area. Therefore, special emphasis was given to those crops in each locality that provided the largest rates of return on the invested capital of the irrigators.

The coastal areas of southern California are generally adaptable to high value crops such as citrus and subtropical frutis, nuts, truck crops, cut flowers, and nursery stock. The Upper Salinas Valley Study Unit of San Luis Obispo County is generally adapted to lower value truck crops, deciduous fruits and irrigated pasture and alfalfa. The Kern County Service Area is generally adapted to cotton, potatoes, and other field crops; grapes, melons, and other truck crops; deciduous fruit; and in certain areas of good air drainage in the foothills of the San Joaquin Valley, citrus fruit. The Antelope-Mojave Service Area appears to be limited to irrigated pasture, alfalfa, single-cropped vegetables, and possibly deciduous fruit.

Historical Agricultural Development Patterns

Over many years, farmers in the southern California area have grown a wide variety of crops, a number of which have been found to be particularly adaptable to local climatic and soil conditions. As the result of many years experience, definite cropping patterns have emerged in the area's various subunits. These cropping patterns, however, have been modified in recent years by the effects of varying market conditions and urban encroachment. Within the limitations imposed by climate and soil, the effect of varying market conditions, coupled with economic pressure for the highest possible returns on the use of land, has resulted in shifting from the less profitable crops in the pattern of a given subunit to those most profitable. However, urban encroachment has resulted, in many subunits, in the loss to agriculture of those lands with the most favorable climatic and soil conditions. This is particularly true in subunits adapted to the growing of citrus fruits.

The general trend in the southern California area over the past 10 years, both in the shifts in general cropping patterns and in the direction of change in total productive acreage, is indicated in the following:

(1) The 10-year period, 1948-1957, has shown the following results by crop groups.

  a. Citrus acreage declined from 269,000 acres to 168,000 acres; a loss of 101,000 acres.

  b. Noncitrus fruit, nut, and vine crops acreage declined from 184,000 acres to 130,000 acres; a loss of 54,000 acres.

  c. Truck crop acreage increased from 218,000 acres to 229,000 acres; a gain of 11,000 acres, including some nonirrigated lands.

  d. Field crop acreage increased from 1,206,000 acres to 1,409,000 acres; a gain of 204,000 acres, including both irrigated and nonirrigated lands.

(2) The period 1948-1957 has shown a net gain in productive acreage, including both irrigated and dry farmed lands, of 60,000 acres with changes in the counties as follows:

  a. Kern County increased 156,000 acres.

  b. San Luis Obispo County increased 61,000 acres.

  c. Riverside County, excluding desert areas, increased 22,000 acres.

  d. Ventura County increased 10,000 acres.

  e. San Diego County increased 5,000 acres.

  f. Los Angeles County decreased 107,000 acres.

  g. Orange County decreased 31,000 acres.

  h. San Bernardino County decreased 34,000 acres.

  i. Santa Barbara County decreased 22,000 acres.

The land use surveys reported in Chapter II identify the present cropping patterns in the more than 100 agriculturally important subunits, and were used in establishing a base from which projections of trends under assumed future conditions could be made.

Market for Farm Products

An analysis was made on a national scale of the potential future market for 33 basic crops which have an important place in the agriculture of the southern California area. These crops are:

(1) Citrus and subtropical fruit

a. Navel oranges
b. Valencia oranges
c. Lemons
d. Grapefruit
e. Avocados
f. Olives

(2) Deciduous fruits, nuts, and grapes

a. Peaches
b. Apricots
c. Plums
d. Apples
e. Pears
f. Almonds
g. Walnuts
h. Wine grapes
i. Table grapes
j. Raisin grapes

(3) Truck crops

a. Lettuce
b. Celery
c. Lima beans
d. Green beans
e. Sweet corn
f. Broccoli
g. Onions
h. Tomatoes (market)
i. Artichokes
j. Watermelons
k. Cantaloupes

(4) Field crops

a. Sugar beets
b. Irish potatoes
c. Dry beans
d. Alfalfa
e. Field corn
f. Cotton

Major assumptions employed in analyzing the long-term national demand for these products are identical to those used in the population studies, as presented in Chapter III. In addition to these assumptions, it was assumed that: (1) future price relationships will resemble those of

1952-1956, and (2) levels of per capita consumption of the various agricultural products will continue to reflect the influence of rising living standards.

In developing the market outlook studies, use was made of available commodity studies of the University of California Agricultural Experiment Station and Agricultural Extension Service; the United States Department of Agriculture; California Federal-State Crop and Livestock Reporting Service; the California Department of Agriculture, Region II; Bureau of Reclamation of the United States Department of Interior; Sunkist Growers of California; California Avocado Society; California Planting Cotton Seed Distributors; Kern County Potato Growers Association; Stanford Research Institute; the National Cotton Council of America; and the United States Department of Commerce.

National consumption of farm produce was projected to the year 2020, based upon historical data correlating population and crop consumption. The per capita consumption trends were extended on conservative bases and applied to the projected population of the nation presented in Chapter III. The percentage of national consumption supplied by California was assumed to change only slightly from present levels, with a few exceptions such as cotton and Valencia oranges. Results of the study are presented in Table 29 and in Attachment No. 11, Table No. 96. The following tabulation of several major crops summarizes the study, with values in millions of pounds:

TABLE 29

PROJECTED CONSUMPTION BY THE UNITED STATES OF THE TOTAL PRODUCTION AND CALIFORNIA PRODUCTION OF SELECTED CROPS

(In pounds per capita)

Crop	1960-1969		1970-1979		1980-1989		1990-1999		2000-2009		2010-2019	
	Consumption of total production	Consumption of California production	Consumption of total production	Consumption of California production	Consumption of total production	Consumption of California production	Consumption of total production	Consumption of California production	Consumption of total production	Consumption of California production	Consumption of total production	Consumption of California production
Avocados	0.73	0.48	0.96	0.63	1.19	0.78	1.42	0.93	1.65	1.09	1.88	1.24
Lemons[a]	7.9	7.7	8.4	7.9	9.0	8.3	9.5	8.5	10.1	8.8	10.6	9.1
Navel Oranges[a]	36.4	7.1	37.9	7.6	39.5	8.2	41.1	8.8	42.7	9.4	44.2	9.9
Valencia Oranges[a]	33.4	7.0	35.4	7.7	37.3	8.5	39.4	9.3	41.3	10.0	43.5	10.8
Almonds	0.648	0.599	0.704	0.626	0.759	0.675	0.806	0.717	0.848	0.755	0.866	0.770
Peaches	15.7	10.6	15.6	10.8	15.4	11.2	15.3	11.4	15.2	11.8	15.1	11.9
Plums	1.06	1.00	1.09	1.02	1.12	1.03	1.15	1.05	1.18	1.07	1.21	1.08
Walnuts	1.055	0.819	1.090	0.840	1.126	0.870	1.162	0.906	1.198	0.952	1.229	1.003
Alfalfa	730	756[b]	745	710[b]	761	664[b]	777	618[b]	792	572[b]	809	527[b]
Cotton Lint[a]	36.8	4.8	35.5	6.1	34.2	7.2	33.4[a]	8.0	32.6[a]	8.7	31.9[a]	9.3
Dry Beans	5.1	1.70	3.9	1.35	3.5	1.15	3.1	1.00	2.8	0.90	2.6	0.85
Field Corn	1,140	73.8[b]	1,160	75.5[b]	1,205	77.2[b]	1,235	78.8[b]	1,265	80.7[b]	1,295	82.1[b]
Irish Potatoes	95	15.7	91	15.5	88	15.4	84	15.3	80	15.2	77	15.1
Sugar Beets	163	46.7	164	47.0	165	47.2	166	47.6	168	47.9	169	48.2
Broccoli	1.51	1.02	1.75	1.19	1.97	1.36	2.18	1.53	2.37	1.70	2.54	1.87
Cantaloupes	9.2	4.2	9.3	4.3	9.5	4.5	9.7	4.6	9.8	4.7	9.9	4.9
Celery	9.45	5.50	10.10	6.10	10.75	6.65	11.40	7.25	12.15	7.80	12.8	8.40
Green Limas	2.67	0.40	2.70	0.46	2.74	0.52	2.77	0.58	2.81	0.63	2.84	0.68
Lettuce	22.5	12.9	24.7	14.2	26.2	15.5	27.6	16.8	28.7	18.0	29.6	19.4
Watermelons	18.2	1.6	18.1	1.6	18.1	1.6	18.1	1.6	18.0	1.6	18.0	1.6
Sweet Corn	24.8	12.1[b]	25.0	12.5[b]	25.3	12.9[b]	25.3	13.5[b]	25.3	13.9[b]	26.1	14.4[b]
Tomatoes	55.0	28.4	57.0	30.4	59.1	32.4	61.2	34.4	63.4	36.4	65.6	38.4
Raisin Grapes[a]	NA	19.6	NA	20.5	NA	21.3	NA	21.8	NA	22.0	NA	22.1
Table Grapes[a]	NA	7.6	NA	8.6	NA	9.5	NA	10.3	NA	10.8	NA	11.0
Wine Grapes[a]	NA	7.1	NA	7.8	NA	8.6	NA	9.2	NA	9.7	NA	10.0
Apples	27.5	2.50	29.0	2.43	30.0	2.37	31.0	2.31	32.5	2.25	34.0	2.20
Apricots[a]	2.57	2.45	2.67	2.55	2.76	2.64	2.86	2.72	2.95	2.82	3.05	2.91
Artichokes	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Asparagus	1.72	1.12	1.80	1.14	1.90	1.16	1.99	1.18	2.07	1.20	2.16	1.22
Olives	1.38[c]	0.63	1.44[c]	0.66	1.51[c]	0.69	1.58[c]	0.72	1.64[c]	0.75	1.71[c]	0.78
Onions	10.6	2.2	10.4	2.3	10.2	2.4	10.1	2.6	9.9	2.7	9.7	2.8
Pears	6.1	4.7	6.3	4.8	6.4	5.0	6.6	5.2	6.8	5.4	7.0	5.6

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a. Includes exports.

b. California per capita consumption of California production. These crops grown for California markets only.

c. United States import rate per capita plus California production.

NA Not available.

	Average 1950-1956			Average 1980-1990		
		Historical market for production			Projected market for production	
Crop	Total national consumption	California	Southern California	Total national consumption	California	Southern California
Avocados	72	49	49	318	209	209
Potatoes	16,539	2,573	1,674	23,549	4,121	3,115
Sugar Beets	24,770	6,839	796	44,154	12,631	798
Cotton Lint	6,776	720	227	9,152	1,920	277
Celery	1,374	735	401	2,877	1,779	560
Lemons	922	894	871	2,408	2,221	1,829
Navel Oranges	5,369	1,134	669	10,570	2,194	1,001
Peaches	2,477	1,534	37	4,121	2,997	24
Artichokes	32	32	7	54	54	16

It will be noted that the market for the California crops shown above is expected to approximately double in the next 20 to 30 years. Because of the magnitude of projected population increases beyond that time, the foregoing trends may be expected to continue. Based upon these studies, it was concluded that the markets for agricultural products that may be grown in the area would not, in general, be a limiting factor on the development of irrigated agricultural acreage.

The outlook for some of the more important crops grown in southern California, as shown in Table No. 96, Attachment No. 11, is discussed in the following paragraphs in terms of California's production:

(1) Lemons. In spite of the indicated decrease in the proportion of the United States market, from 97.4 per cent in 1960-70 to 85.8 per cent in 2020, annual demand for California lemons was expected to increase from 1,507 million pounds in 1960-70 to 3,607 million pounds in 2020. Production of California lemons in 1957 was 1,280 million pounds.

(2) Navel oranges. There is no competition from other areas except for a small acreage in Arizona. The annual United States market demand for California navels was projected as 1,389 million pounds in 1960-70 and 3,924 million pounds in 2020. Production of California navels in 1957 was 1,163 million pounds.

(3) Valencia oranges. There is heavy competition from Florida for canned orange products, but California Valencia oranges have had more appeal and thus have created a greater demand as fresh fruit. The annual United States market demand for California Valencias in 1960-70 was projected at 1,370 million pounds, increasing by 2020 to 4,281 million pounds. Production of California Valencias in 1957 was 1,505 million pounds. The projected decrease in California's share of the Valencia market is based on the anticipated heavy loss of acreage to urban growth in the southern California area, which has 88 per cent of the State's Valencia acreage.

(4) Avocados. The United States annual market demand for California production in 1960-70 was estimated at 93.9 million pounds, and was projected at 491.5 million pounds in 2020. Production in 1958 in California amounted to 84 million pounds.

(5) Lettuce. Lettuce, one of the foremost truck crops in terms of production, experienced a 1957 California production of 2,052 million pounds. California's annual production in 1960-70 was projected at 2,524 million pounds.

(6) Cotton lint. California was expected to continue to supply a large share of the United States market, with annual production in California in 1960-70 forecast at 936 million pounds, up from the present production of 768.5 million pounds. The projected increase in per cent of the nation's production, from 11 per cent at present to 29 per cent in 2020 was based on the State's ability to produce cotton more efficiently than most other producing sections. With projected United States population growth, it was estimated that cotton will cease to be in surplus.

(7) Alfalfa. California annual production during the 1960-70 decade was projected at 14,062 million pounds, up from present production of 10,880 million pounds.

(8) Sugar beets. The annual United States market for California production in the 1960-70 decade is expected to be 9,092 million pounds. By 2020, this market was estimated to grow to 19,106 million pounds, compared to California's present production of 8,682 million pounds.

Computation of Residual Income

When farm production costs, other than water charges, are deducted from gross crop returns, the remainder, or residual income, represents (1) the amount available for payment of water charges and (2) an incentive to the farmer to compensate for the risks inherent in developing new lands and continuing operations. It will be recognized, other conditions being equal, that as water costs to the farmer increase the incentive to farm decreases. A reduction of the incentive below a certain point will result in cessation of production of the crop considered.

Estimates were made of residual income for the various crops under consideration. A farm budget case study was made for each important agricultural subunit in the Counties of San Luis Obispo, Santa Barbara, Ventura, and Orange, and for Riverside, San Bernardino and Los Angeles Counties, excluding desert areas. Information was obtained on actual current costs of production, yields, prices received by farmers, unit use of water, peak irrigation months, irrigation systems, farm investments, farm development costs, size of farm, influence of climatological factors, markets for crops, farm family living expenses, etc. (Farm family living expenses include such items as housing, food, clothing, insurance, medical, and personal automobile expenses.)

For subunits in the Kern County Service Area, coastal San Diego County, and the Antelope-Mojave Service Area, the principal source of data for residual income determinations was the University of California Agricultural Extension Service.

Residual income estimates for each significant crop and livestock enterprise within the agriculturally important subunits were arrived at by a generalization of the data obtained through the case study and Extension Service methods. The generalization was made to eliminate yield and cost of production factors peculiar to the specific case itself and resulted in values applicable to the entire subunit under consideration. Further modifications were instituted to account for variations in yields and costs due to differences in land classification and climate within the subunit.

Crop yields, after having been generalized for the subunit, were then compared with information regarding yields obtained from County Agricultural Commissioner Reports, County Agricultural Extension Services, the California Citrus League and the Calavo Growers of California. The yields finally selected for each crop were chosen to be consistent with yields normally attainable by economically successful growers in the subunit. This basis for selecting crop yields was used because economic analysis demands that reasonable farm management be practiced and that economical production methods be used. This, for all practical purposes, limited yield considerations only to farms and farmers that have been economically successful.

Price-Cost Base. A further modification made to the data was the conversion of price and cost factors to a 1952-56 price-cost base. This base was adopted because it was believed that it reflected a relationship between farm income and costs that is expected to continue in the future, even though there is current evidence of a price-cost squeeze. The conversion to the 1952-56 base was accomplished by utilizing The United States Department of Agriculture index of prices paid (1910-1914 average = 100). Prices received by farmers were computed as local F.O.B. prices less packing house charges, and were then converted to the 1952-56 base as noted above.

This basis for prices paid and received is believed valid because margins between agricultural income and production costs tend to remain relatively the same despite trends in production, prices and technological advances.

In enterprises as competitive as the agricultural industry, profits tend to stay very close to the break-even point. When profit margins increase, due to a widening gap between income and costs caused by technological advance or other factors, new producers are induced into production. New producers increase the total supply in relation to demand and thus prices and profit margins are forced downward. On the other hand, when costs exceed revenues, enough producers are forced out of production to decrease the supply to a point where supply and demand relationships raise prices to a profitable level.

Technological advance does little to increase farmers' net returns. This is illustrated by the fact that there have been marked technological advances during the past decade, while farmers' returns have generally been declining. Economic conditions, on the other hand, have much more effect on agriculture. Ultimately, supply and demand factors dictate farmers' returns. Because of the high degree of competition in agriculture, supply and demand conditions, over the long term, keep profitability at a relatively low level. Inflationary trends and artificial restrictive conditions, such as price controls, often disrupt the forces of supply and demand, but in agriculture have only temporary effects.

The "price-cost squeeze", as evidenced in the past few years, is due to oversupply conditions relative to demand for the products. It is no new phenomenon since it has occurred several times in the past. Major price-cost squeezes were in effect in 1921-25, 1930-35, and 1938-42. These squeezes will no doubt appear from time to time in the future, as long as agriculture remains in its present character.

Over the long term, the spread between gross returns and costs of production will tend to be small. In summary, the price-cost squeeze and returns to farmers were considered in determining the base period for measuring prices and costs, but was not given any further weight after the base period was selected. The period used in the analysis, 1952-56, is one of relatively stable prices paid for factors of production, and of declining prices received for agricultural produce. Thus, the use of this period as a base tends toward conservatism in forecasts of future conditions and therefore minimizes overstatement of demands for irrigation water.

Residual Income. The residual incomes, available for water payments and incentive to farm, are presented for the service areas in Attachment No. 12, Tables 97 through 105, which show for each service area the derivation of unit residual income by crops. Illustrative of the results of the studies of residual income for payment of water charges and for incentive to farm are the ranges in residual incomes for several crops shown in the following tabulation:

Crop	Range of values of residual income per acre-foot
Avocados	$39 - 162
Navel Oranges	15 - 96
Lemons	96 - 188
Walnuts	50 - 155
Table Grapes	27 - 36
Lettuce	33 - 106
Celery	59 - 74
Melons	28 - 102
Dry Onions	48 - 142
Cotton	15 - 39
Alfalfa	2 - 14
Sugar Beets	7 - 60
Dry Lima Beans	17 - 39

The range in values for residual income shown for each crop reflects differences between subunits in yield, land development costs, prices received, and other variables associated with farming.

Rate of Return on Investment

In all enterprises involving the use of capital, the return to capital invested, compared to the risks involved, is one of the most significant factors governing investments in those enterprises. As this principal applies to agricultural operations as well as to other business enterprises, determination of the rate of return to capital invested in farms in each subunit was a very important step in estimating the rapidity of development.

The rate of return on capital invested is the ratio between net profits and the farmer's equity in the farm. Net profits were calculated by adding the management charge to the residual income previously determined and subtracting the estimated costs of project water. Management charges were not included as costs in determining the net profits because they are not generally a cash cost chargeable to the farming operation in the southern California area. In all nine counties of the area, farms are preponderantly owner-operated or tenant-operated, and there are only an insignificant number of manager-operated farms. Table 30 summarizes the operation of farms in the southern California area as derived from the 1954 United States Census of Agriculture.

TABLE 30

FARMS BY TYPE OF OPERATOR IN THE
SOUTHERN CALIFORNIA AREA

County	Owners and tenants		Managers		Owners and tenants		Managers	
	Number	Per cent of total	Number	Per cent of total	Acres	Per cent of total	Acres	Per cent of total
Kern	2,265	98	48	2	2,691,000	84	510,000	16
San Luis Obispo	1,808	98	40	2	1,204,000	80	308,000	20
Santa Barbara	1,319	96	55	4	734,000	69	323,000	31
Ventura	1,749	94	107	6	320,000	66	165,000	34
Los Angeles	8,071	98	183	2	610,000	82	133,000	18
Orange	4,530	99	63	1	325,000	73	119,000	27
Riverside	4,738	97	168	3	647,000	77	197,000	23
San Bernardino	5,365	98	110	2	1,545,000	97	55,000	3
San Diego	6,375	98	103	2	761,000	77	232,000	23
TOTAL OR AVERAGE	37,220	98	877	2	8,837,000	81	2,042,000	9

Note: Source of Data: 1954 Census of Agriculture, United States Department of Commerce.

The risks involved in any particular farming operation influence the required rate of return to capital. The principal sources of much of the long-term capital for purchase of raw or developed land are banks and insurance companies. However, where climatic or soil conditions make the probability of uniformly successful crop yields small, or where there is only a limited supply of water available, many agencies will not make loans to farmers. Thus, in these areas of higher risks, farmers must obtain the necessary capital from noninstitutional lenders, which usually results in higher interest costs and thus a need for higher rates of return.

In regard to the availability of capital at low interest rates in areas to receive project water, surveys of opinion indicated that capital from banks and insurance companies would be available when project water was ready for delivery in sufficient amounts to support the rate of growth as projected.

The return on farmers' equity capital required to provide an adequate incentive to farm is a function of both the amount of capital needed and the element of risk involved in the agricultural enterprise. These returns were estimated for the major crops in each area under project water conditions and costs and are shown in detail in Attachment No. 13, Tables 106 through 111, and are summarized in Table 31. These rates of return appear to be adequate to stimulate the investment of capital in the development of raw land to irrigation at the rates projected in the study.

TABLE 31

RETURNS TO CAPITAL INVESTMENT BY IRRIGATED CROPS

Area	Crop type	Equity investment[a]	Gross income	Total costs[b]	Return to capital	
					Per acre	Per cent
San Luis Obispo Service Area	Deciduous Fruits[c]	$ 983	$ 517	$ 328	$189	19.2
	Truck Crops	1,525	1,875	1,594	281	18.5
	Field Crops	698	370	294	76	10.9
	Weighted Average	1,255	1,257	1,028	229	18.5
Santa Barbara Service Area	Citrus and Avocados	2,025	1,376	1,009	367	18.1
	Deciduous Fruits[c]	910	524	320	204	22.4
	Truck Crops	1,605	1,730	1,533	197	12.3
	Flowers	1,800	2,950	2,379	571	31.7
	Field Crops	547	287	231	56	10.3
	Weighted Average	1,535	1,425	1,184	241	15.7
Ventura County Service Area	Citrus and Avocados	2,025	1,282	1,048	234	11.5
	Deciduous Fruits[c]	1,350	502	403	99	7.3
	Truck Crops	1,860	1,195	976	219	11.8
	Flowers	1,800	2,950	2,533	417	23.2
	Field Crops	975	316	270	46	4.7
	Weighted Average	1,797	1,054	861	193	10.7
Coastal Riverside County	Citrus and Avocados	1,725	1,156	852	304	17.6
	Truck Crops	1,150	1,148	996	152	13.2
	Weighted Average	1,288	1,150	968	187	14.5
Coastal San Diego County	Citrus and Avocados	1,500	1,074	741	333	22.2
	Deciduous Fruits[c]	1,200	925	747	178	14.8
	Truck Crops	1,220	1,501	1,252	249	20.4
	Flowers	1,800	2,950	2,533	417	23.2
	Weighted Average	1,400	1,247	944	303	21.6

RETURNS TO CAPITAL INVESTMENT BY IRRIGATED CROPS
(continued)

Area	Crop type	Equity investment[a]	Gross income	Total costs[b]	Return to capital	
					Per acre	Per cent
Kern County Service Area	Citrus	$ 773	$ 670	$ 576	$ 94	12.2
	Deciduous Fruits[c]	599	597	444	153	25.5
	Truck Crops	362	631	500	131	36.3
	Alfalfa and Pasture	374	203	191	12	3.1
	Field Crops	315	300	228	72	22.8
	Weighted Average	395	402	314	88	22.3

a. Computed as 50 per cent of total average investment in Kern County and 75 per cent of total average investment in all other areas.

b. Excluding management charge and all noncash costs except depreciation.

c. Includes nuts and grapes.

Fluctuation in the rate of return to capital investment by individual crops was considerable. The greatest variations were estimated in the Kern County Service Area's crops of potatoes, cotton, table grapes, and melons because of the greater economic effects of differences in land class in this area than in other areas. Other crops showing considerable fluctuation in returns to capital invested are bell peppers and walnuts. The range of returns for several crops in the southern California area are indicated in the following tabulation:

Crop	Range of return to capital investment in per cent
Avocados	14 - 26
Navel Oranges	8 - 17
Valencia Oranges	6 - 10
Lemons	13 - 23
Walnuts	7 - 23
Table Grapes	9 - 24
Bell Peppers	15 - 37
Lettuce	7 - 23
Celery	20 - 25
Melons	19 - 36
Potatoes	3 - 45
Cotton	16 - 27
Alfalfa Seed	3 - 7
Sugar Beets	8 - 17
Dry Lima Beans	5 - 16

Cost of Water to the Farmer

As has been stated, the cost of water at the main aqueduct was assumed to reflect repayment with interest of all costs associated with delivering water to the service area under consideration. It was further assumed that this estimated cost would be based on the alternative route from which water service would be provided at the least cost to the area under consideration. Variations in these assumed conditions would probably result in varying levels of agricultural development, as discussed in Chapter VI.

The residual income for payment of water charges and for farming incentive, for each crop type projected in each study unit, was compared to estimates of the cost of water to the farmer. These estimates of water costs included not only the assumed price of northern California water at the main aqueduct but also costs of conveyance and distribution facilities required to deliver water to the farmer's headgate.

Full recognition of water pricing policies of existing water supply organizations was taken with respect to the influence of these policies on agricultural development. For example, it was assumed that the present water pricing policy of the Metropolitan Water District would prevail in the future. The annual cost of Colorado River water to the District, reflected in debt service on its outstanding bonds plus operation and maintenance costs, are recovered in large part by ad valorem taxes on all lands and improvements within the District. A nominal sale price for water, approximating operation and maintenance costs, is charged on all water sold to member agencies of the District.

From studies of factors of residual income and return on investment, it was found that in the coastal portions of San Diego, Riverside, and San Bernardino Counties, Orange and Ventura Counties, and in south coastal Santa Barbara County, residual income for the relatively high value crops projected for these areas was sufficiently large to justify the conclusion that irrigated agricultural development would not be limited by the cost of water to the farmer. In northern Santa Barbara and San Luis Obispo Counties, it was found that residual income from some of the climatically adapted crops, which could only be grown on a small proportion of the total acreage, would exceed estimated water costs by an amount which would yield adequate rates of return. However, for substantial acreages of land, residual income from adaptable crops indicated that cost of water to the farmer would be a limiting factor on the development of irrigated agriculture on these lands. In Kern County, very large acreages of irrigable land are available on which the costs of project water would not be excessive and there would be a sufficient incentive to farm.

It was found that, under the water price assumptions employed, climatically adapted crops in the Antelope-Mojave Service Area would yield little or no farming incentive; hence there would be no growth in irrigated agriculture even with availability of northern California water. It was further found that in this area ground water tables are declining rapidly with resulting increases in local water costs. Primarily due to these increasing water costs, progressive reductions of irrigated acreages were projected for this area.

Local Organizations for Water Development

An important factor in the rate of increase in irrigation is the existence of local distribution works and/or a political entity to implement water importation and distribution. It will be recognized that in areas where an aggressive water district or agency is already operating and a pattern of water development has been established, included and adjacent areas adaptable to profitable farming operations will readily develop. On the other hand, in areas where such an organization is not in evidence, development of potentially profitable irrigated agriculture may experience delay both in getting started and in reaching full development because of the time-consuming process of district planning and formation followed by the planning, design and construction of a distribution system.

Studies were made in each subunit to evaluate the general level of such organizational and institutional development and to relate it to projections of irrigated agriculture. Data were collected on existing organized water agencies with respect to organization, operation, financial condition of the agency, assessed valuation of the agency's territory, bonded indebtedness and financing capacity, policies of the agency regarding water pricing, planned additions to its distribution works, annexations, and types of water contracts or water rights held by the agency. The general historical pattern of development in the district area was studied to serve as a guide in estimating future development where district officials were unable to predict future policies. In areas lacking local organization, attempts were made through conversation with local residents to assess the possibilities for future organization.

The coastal areas of Los Angeles, Orange, San Bernardino, Riverside and San Diego Counties are in general intensively organized in numerous public and private water service agencies, many of which are member agencies of The Metropolitan Water District of Southern California.

Ventura County and Santa Barbara County have established water organizations throughout most of their areas, and in view of current activity may be expected to experience minimum delay in contracting for imported water.

San Luis Obispo County is organized in a county-wide water district, and is presently concerned with planning of further local water supply developments. It is considered that development of irrigated acreage in this county will be limited more by considerations of water cost than by organizational aspects.

There are several water districts in existence or in the process of formation in the western and southern portions of Kern County covering large areas of irrigable lands. These include the Semitropic, the Wheeler Ridge-Maricopa, and the Rosedale-Rio Bravo Water Storage Districts, which were recently formed for the express purpose of contracting for imported water. At present there is no organized water service agency to act for the Antelope Plain area in southwestern Kern County. This extensive area contains some of the best lands in Kern County, and has one of the highest ratios of residual income to water cost in the Kern County Service Area. However, a substantial portion of the Antelope Plain is held by large corporate owners whose unwillingness to sell their land has been strongly declared, and whose intention of investing in distribution systems and either actively participating in a farming enterprise or leasing to others is unknown. Considering all the factors involved in this area, it was estimated that there would be only moderate delay in organizing and contracting for water and developing distribution facilities therein.

While other factors inhibit the growth of irrigation in the Antelope-Mojave and Whitewater-Coachella Service Areas, the lack of suitable water districts does not. In addition to the existing agencies in these areas, two new agencies in the Antelope-Mojave Service Area were recently approved by the legislature, which may act to expedite the taking of project water therein.

Size of Farm

The factor of size of farm operation was important in the calculations leading to determinations of residual income. Selection of farm size in each important crop category was made through using data collected in field surveys and after interviews with county farm advisors and officials of County Agricultural Stabilization and Conservation Committees. These estimates of farm sizes, shown in Table 32 by crops, vary from ten acres for avocados and strawberries in coastal Los Angeles and Orange Counties and for strawberries in San Luis Obispo and Ventura Counties, to 240 acres for hay and grain farms in Kern and San Luis Obispo Counties.

In projecting the development of citrus and other subtropical fruits in the southern California area, the size of holding was influenced by the ability of these crops to fit into suburban or agricultural-residential living. The smallest of this type of farm analyzed in the study was the ten-acre avocado orchard indicated for coastal Los Angeles and Orange Counties. The very small farm is recognized as furnishing only a part of the total income of the operator. Ability to pay for water for this size of farm is secondary to providing a residence for the operator.

TABLE 32

ESTIMATED FARM SIZES

(In net acres per farm)

Type of farm	San Luis Obispo Service Area	Santa Barbara Service Area	Ventura County Service Area	Kern County Service Area	Coastal River-side County	Coastal San Bernar-dino County	Orange and Coastal Los Angeles Counties	Coastal San Diego and south-western Riverside Counties	Antelope-Mojave Service Area
Alfalfa	150	150	150	160	150	150	--	150	150
Pasture	60	60	60	160	40	40	40	40	--
Sugar Beets	60	60	60	120	--	--	60	--	--
Cotton	--	--	--	120	--	--	--	--	--
Other Field Crops	--	120	60	240	160	160	60	60	160
Hay and Grain	240	--	--	240	--	--	--	--	--
Potatoes	60	60	--	80	80	80	--	--	80
Strawberries	10	--	10	--	--	20	10	20	--
Melons	--	--	--	80	80	--	--	--	80
Other Truck Crops	40	--	40	--	40	40	40	40	80
Flowers, Nursery	--	20-40	--	--	--	20-50	--	--	--
Walnuts, Apricots	40	40	40	--	40	--	--	40	--
Other Deciduous	--	--	--	40	20-40	20	--	40	--
Grapes	--	--	--	80	--	--	--	--	--
Navel Oranges	--	--	--	40	40	40	20	--	--
Valencia Oranges	--	--	30	--	--	--	20	30	--
Lemons	--	30	30	--	40	40	20	30	--
Avocados	--	15	15	--	--	--	10	30	--

Projection of Irrigated Acreage

The projection of acreage in irrigated agriculture for each subunit consisted of the following progressive steps:

(1) Determination of the extent and character of lands adapted to irrigated agriculture.

(2) Compilation of a list of crops adaptable to the land classes and climate of the area.

(3) Tentative projections of cropping patterns based on studies of present and historical cropping patterns.

(4) Upper limits of acreages by crops estimated through using results of studies of the market demand for products of irrigated agriculture of the types employed in the projected crop pattern.

(5) Using tentative projections of cropping patterns, computation of residual income available for payment of water charges and incentive to farm for each crop in pattern.

(6) Estimation of net revenues and anticipated net return to the investment in the farm for each crop, with those crops and lands in the tentative projection that did not produce sufficient returns to compensate for the risks involved being eliminated.

(7) Final selection of the land areas and cropping patterns that will provide sufficient return (or incentive) to justify the necessary investment and compensate for the risks involved.

(8) The rate of change in irrigated agriculture from present levels to the projected levels of development made, based on studies of existing and planned local organizational structures and policies and general pattern of water development, with principal weight given to the magnitude of the farming incentive, or the return to invested capital.

The last five foregoing steps comprise a process of progressive modification of the originally selected rough pattern of irrigated acreage, eliminating otherwise suitable acreages upon which incentive to farm would not be sufficiently large to stimulate development.

Based upon this procedure, forecasts of areas of development in irrigated agriculture were prepared for each subunit by decades from 1960 to 2020. The results of the studies are summarized in Table 33 and Figure 15, "Projected Areas of Irrigated Crops in Southern California Area", and are listed in detail in Attachment No. 14, Tables 112 through 125.

It is believed that through careful application of the foregoing procedures, the intangible factor of willingness to pay has been properly evaluated for where there was (a) expressed resistance to payment of estimated water costs, or (b) no local activity to form organizations or districts to take water, or (c) an alternative source of water supply available at less cost, then the estimated water deliveries in the area were delayed for the estimated periods of time necessary for these factors to lose their effect. In spite of expressed local resistance to pay the estimated price of water, if studies indicated a large potential incentive to use project water, there was no alternative than to assume, over a long-range period, that irrigators would act to take advantage of that potential.

Thus it can be seen that willingness to pay is secondary and indirect, although important, as a concept for use in project formulation studies. The concept is more in the nature of a conclusion drawn from more objective factors than an operating factor in its own right. Willingness to pay was implicit in each case where there was ample ability to pay, plus an adequate return to capital invested. Willingness to pay, therefore, is not a controlling factor in itself, but an influencing factor.

TABLE 33

PRESENT AND PROJECTED NET AREAS OF IRRIGATED CROPS[a]

(In thousands of acres)

Area	1957	1960	1970	1980	1990	2000	2010	2020
Coastal San Diego County and Southwestern Riverside County[b]	61[c]	61	95	121	151	166	174	178
Present Metropolitan Water District Service Area	48[c]	47	75	108	128	134	129	117
Coastal Riverside County[b]	76	75	70	66	64	62	56	46
Present Metropolitan Water District Service Area	72	72	67	63	62	60	54	44
Coastal San Bernardino County	82	80	67	48	31	18	8	0
Present Metropolitan Water District Service Area	46	45	40	32	21	11	5	0
Coastal Los Angeles County	58	22	5	1	0	0	0	0
Present Metropolitan Water District Service Area	44	14	3	0	0	0	0	0
Orange County	97	87	54	18	11	6	1	0
Present Metropolitan Water District Service Area	93	83	51	16	10	5	1	0
TOTALS - PRESENT METROPOLITAN WATER DISTRICT SERVICE AREA	303	261	236	219	221	210	189	161
TOTALS - SOUTHERN CALIFORNIA COASTAL PLAIN AND COASTAL SAN DIEGO COUNTY	374	325	291	254	257	252	239	224
Ventura County Service Area	117	122	124	111	94	84	63	51
TOTALS - SOUTH COASTAL AREA	491	447	415	365	351	336	302	275

PRESENT AND PROJECTED NET AREAS OF IRRIGATED CROPS[a]
(Continued)

(In thousands of acres)

Area	1957	1960	1970	1980	1990	2000	2010	2020
Santa Barbara Service Area[d]	72	72	72	83	89	89	92	93
San Luis Obispo Service Area[e]	18	20	23	31	43	44	42	38
TOTALS - SANTA BARBARA AND SAN LUIS OBISPO SERVICE AREAS[d,e]	90	92	95	114	132	133	134	131
Antelope-Mojave Service Area	89	90	87	78	66	50	32	28
Whitewater-Coachella Service Area[f]	--	--	--	--	--	--	--	--
Kern County Service Area	335	358	432	606	771	831	810	797
TOTALS - SOUTHERN CALIFORNIA AREA	916	988	1,028	1,161	1,319	1,350	1,279	1,231

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a. Net area excludes roads, highways, farm lots, and nonirrigable lands within gross irrigated land areas.

b. That portion of coastal Riverside County that will be served from the San Diego Aqueduct is tabulated with San Diego County.

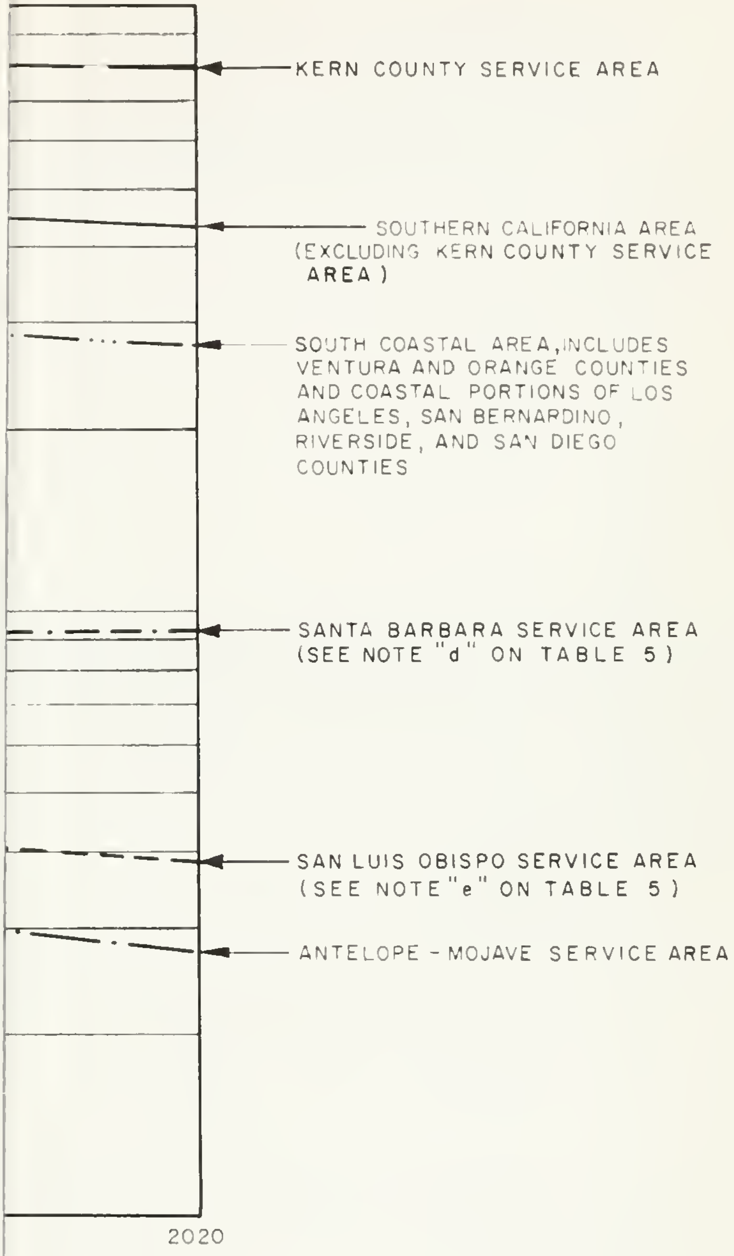
c. Estimate based on San Diego County Agricultural Commissioner Report, 1957.

d. Excludes Cuyama area of Santa Barbara County.

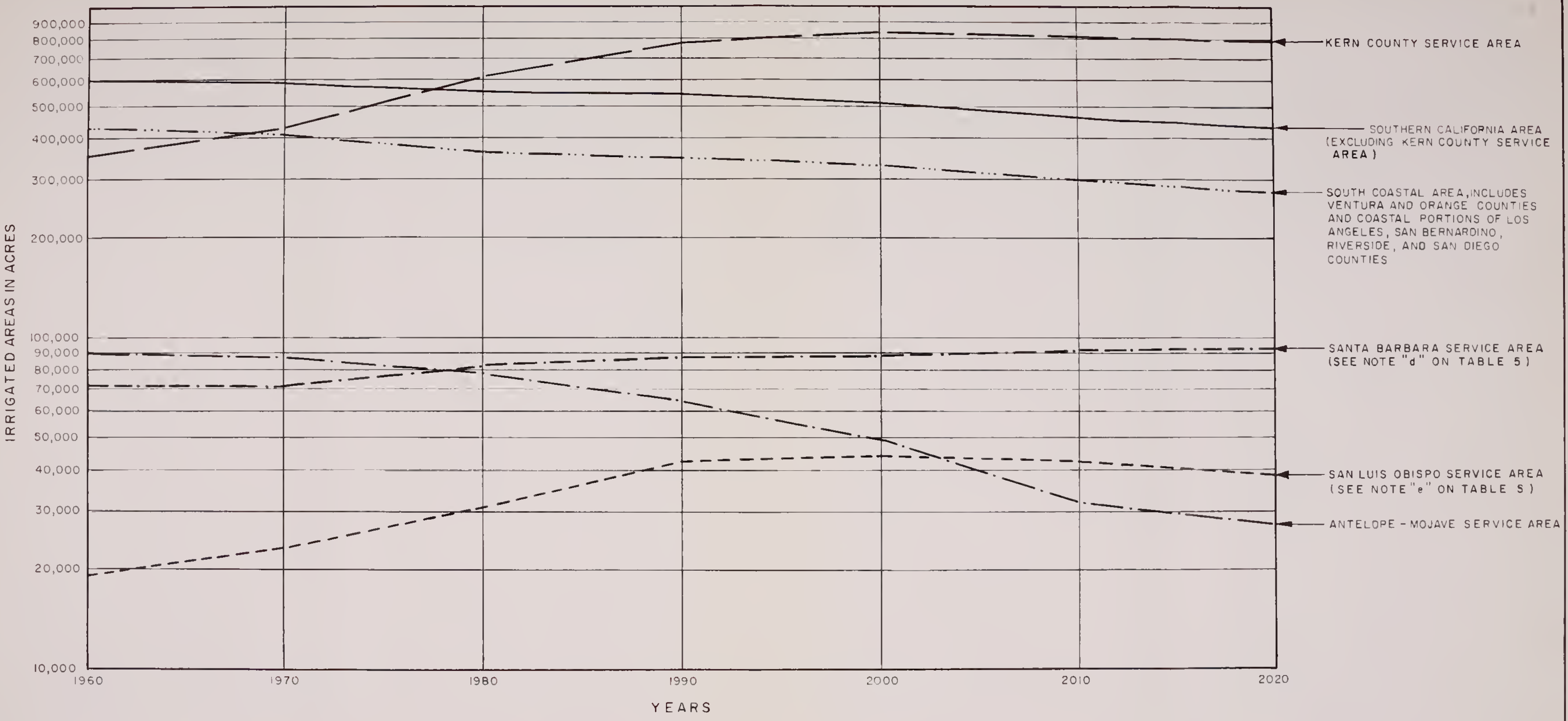
e. Excludes Santa Maria, Carrizo Plain, and Cuyama areas of San Luis Obispo County.

f. Agricultural acreages for Whitewater-Coachella area not tabulated.

FIGURE 15



IA AREA



PROJECTED AREAS OF IRRIGATED CROPS IN THE SOUTHERN CALIFORNIA AREA

CHAPTER V. WATER REQUIREMENTS

Total future net water requirements* for each subunit were estimated by applying appropriate values of unit water use to the projections of population and irrigated acreage therein.

Projections of net unit urban water use were based upon studies of historical patterns of urban water deliveries as compared to population in cities of the southern California area; derivation of the relations of temperature, precipitation, personal income, price of water, and industry upon unit urban water deliveries; determinations of present and future extent of areas connected to ocean outfall sewers; and the extent of areas overlying or tributary to unconfined ground water basins.

Net values of unit agricultural water use were based upon prior studies by the Department of Water Resources as reported in its publications.

Unit Urban Water Use

In general, two different procedures may be followed in deriving urban water requirements: (1) water requirements based upon the annual amounts of water delivered per unit area of urban land, and (2) water requirements based upon annual amounts of water delivered per capita. Due to the lack of data on trends in water requirements per unit urban area and the relatively large amount of data on a per capita basis, the latter method was used in this study.

*Net water requirement is defined as the applied water needed to provide for all beneficial uses and for all irrecoverable losses incidental to such uses for existing or estimated conditions at the point in time under study.

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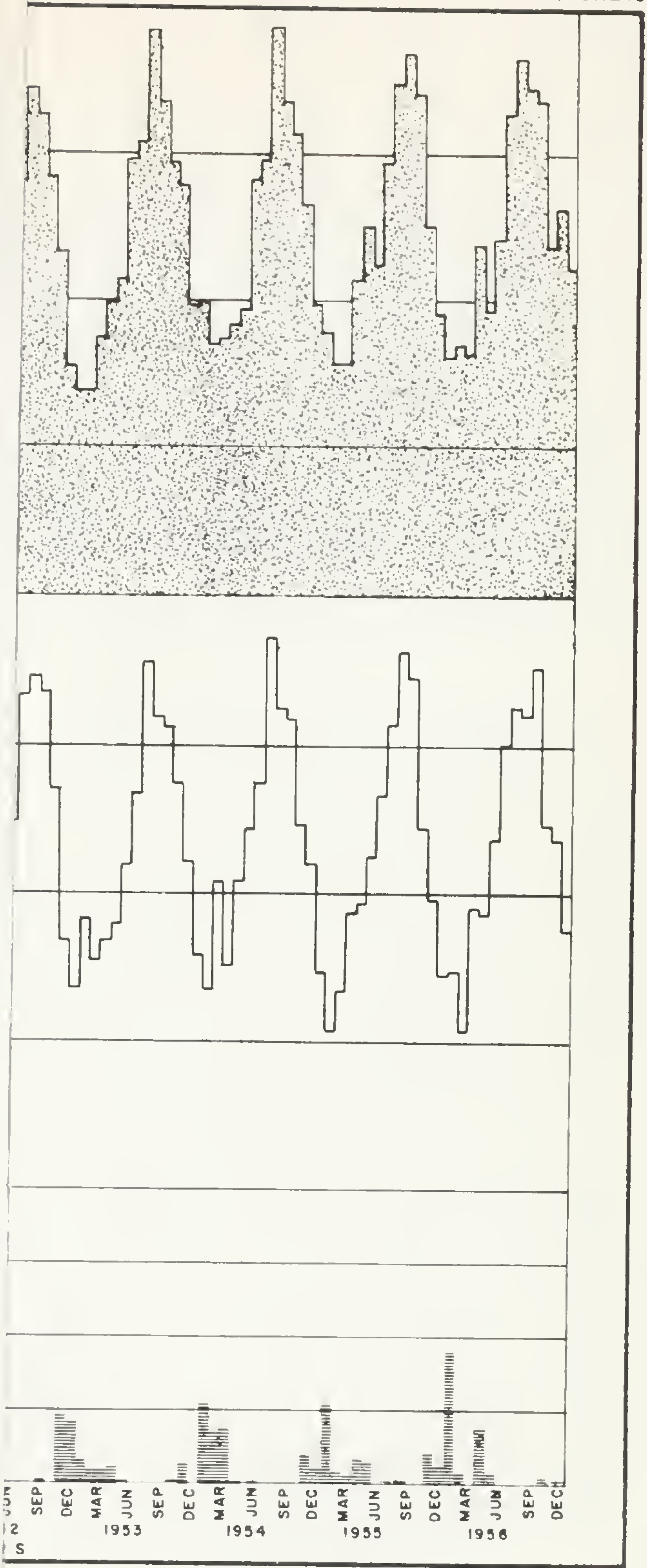
*Net water requirement is defined as the applied water needed to provide for all beneficial uses and for all irrecoverable losses incidental to such uses for existing or estimated conditions at the point in time under study.

Unit urban water use as determined in this study encompasses all water usage in an urban area, including industrial, commercial, residential, and municipal, as well as losses occurring within the urban distribution system. First, the quantities of applied water, excluding precipitation, were projected on a unit basis. Next, each ground water basin was studied to determine the percentage of applied water that would be available for re-use. This latter study resulted in the projection of net unit urban water use by subunits.

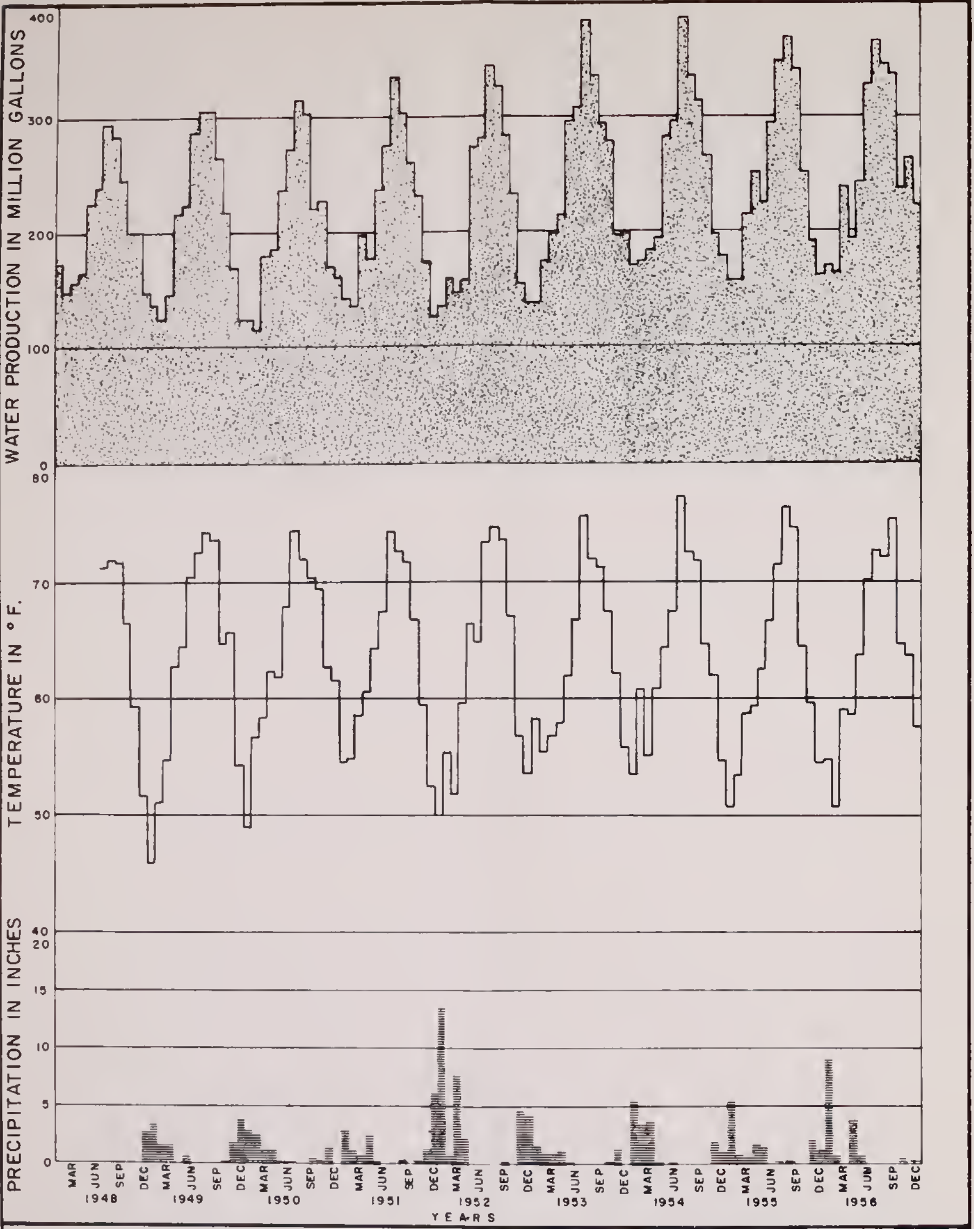
Analysis of Historical Data

About 50 cities located in the southern California area were contacted and data on water production and urban population were obtained. The data collected were of varying quality and usefulness, making it necessary to evaluate each city's records to eliminate errors and inaccuracies and account for incomplete coverage of either water production or population data, lack of meter readings of production of water, and other inconsistencies. The total water production and per capita production information obtained were related to data obtained from United States Weather Bureau bulletins on monthly average temperature and annual precipitation. These data for the City of Alhambra are depicted on Figure 16, and similar charts for the other cities investigated were prepared. By studying these charts depicting water consumption, precipitation, and temperature, the effects of precipitation and temperature upon the rates of urban water deliveries were evaluated.

FIGURE 16



MONTHLY MEAN TEMPERATURES,
PRECIPITATION
F ALHAMBRA



MONTHLY WATER PRODUCTION, MONTHLY MEAN TEMPERATURES, AND MONTHLY PRECIPITATION FOR CITY OF ALHAMBRA

Other factors that may have influence on levels and rates of growth in unit urban water use were searched out and analyzed. These included the levels of personal income by areas, the selling price of water, and the industrial use of water. A brief summary of the analysis of each factor effecting unit urban water use follows:

Temperature. Evaluation of Figure 16 and similar charts showed that temperature variations influence monthly levels of water usage to a marked degree, with the yearly peak water usage occurring during the months experiencing the yearly peak temperatures. These charts also demonstrated that summer usage rates are from two to three times as great as winter rates, and inland cities, with higher average temperatures, were found to have higher peak summer usage rates than coastal cities. An average monthly peak of 11.3 per cent of yearly total water deliveries was found for the month of July for coastal cities while cities in the Upper Santa Ana River Basin show a July peak of 13.4 per cent of the yearly total deliveries. In addition to the larger requirement for water for air conditioning and application to lawns and landscaping caused by high temperatures, evaporation of water is also considerably influenced by temperature conditions.

These effects of temperature on water usage were considered in projecting unit urban water use through the grouping of urban areas into regions of similar temperature conditions and studying the characteristic water usage patterns in each of these regions. The areas within each region are described on Table 34, pages 163 and 164.

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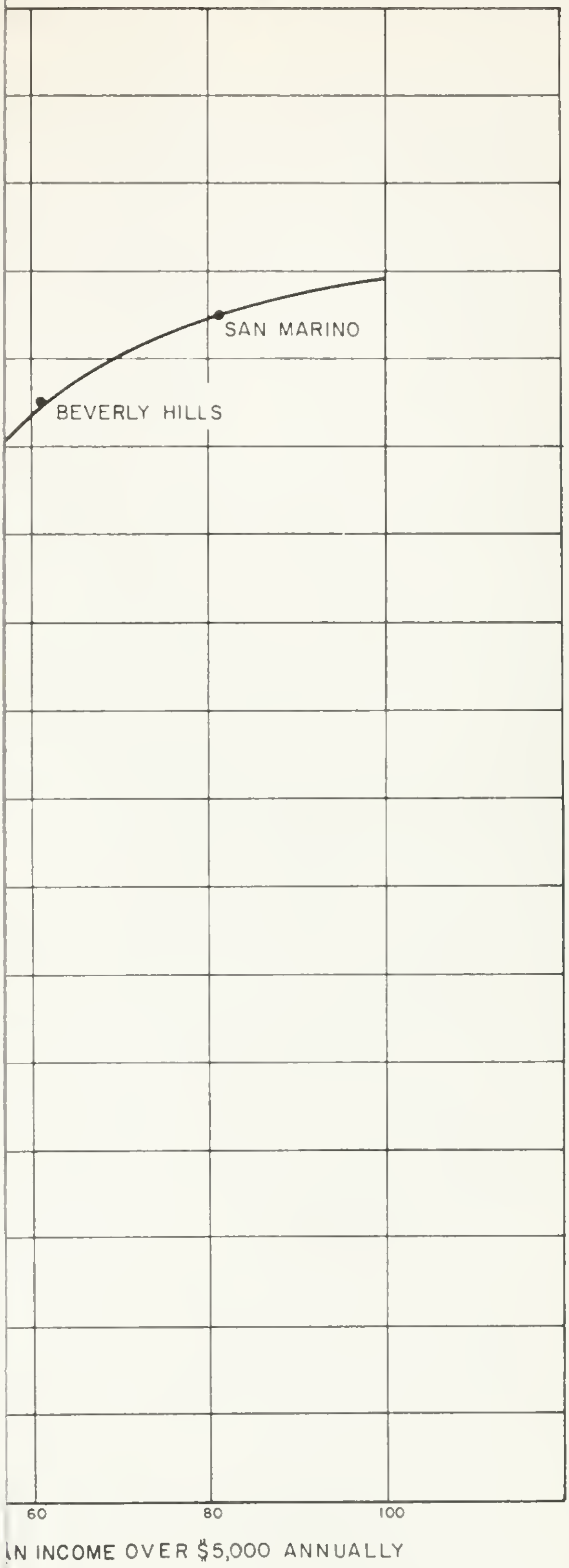
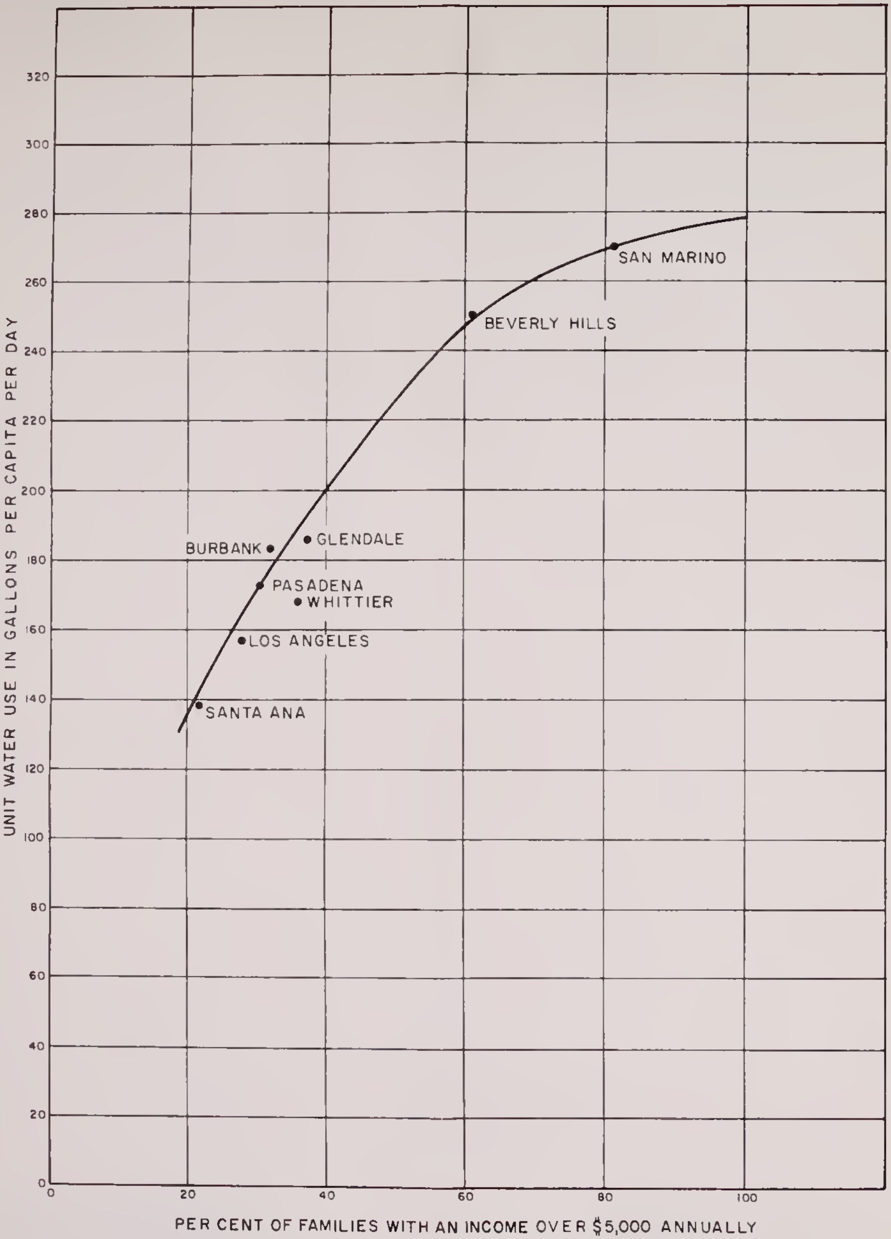
Precipitation. It was observed that variations in precipitation appear to have very little effect on the average yearly water usage of cities within the southern California area due to the seasonal nature of this area's rainfall with more than 90 per cent of the annual rainfall occurring between November 1 and May 1. During this period, most plants, lawns, and trees are growing very slowly. The main effect of precipitation occurs in residential areas in the early fall or late spring. This effect is noticeable on charts comparing the use of water during the months of April and May, and October and November, to the precipitation which occurred during the corresponding period. However, above average precipitation occurring during these periods has little effect upon industrial and commercial use of water. The effect of variations in precipitation on water use in urban areas, being the summation of effects on residential, commercial, industrial, and municipal uses, is slight and was not considered further in projections of unit urban water use.

Personal Income. It was found that levels of personal income in various cities has a highly significant effect upon water usage. Cities with a large percentage of high income families use more water per capita than cities with lower per capita income. This conclusion is evident in the following tabulation of a group of cities which are all part of one large economic unit with similar climatic conditions:



NIT URBAN WATER USE AND
INCOMES IN 1950



RELATIONSHIP BETWEEN UNIT URBAN WATER USE AND URBAN FAMILY INCOMES IN 1950

DEPARTMENT OF WATER RESOURCES

Cities	1950 Unit water use, in gallons per capita per day	1950 Percentage of families with an income over $5,000 per year	1950 Median family income
San Marino	270	81.0	$9,286
Beverly Hills	250	61.0	6,489
Glendale	185	36.9	4,112
Burbank	183	31.9	4,039
Pasadena	173	30.7	3,676
Los Angeles	157	27.7	3,575
Santa Ana	138	21.7	3,376

These data are shown on Figure 17. As can be seen, there is a fairly direct relationship between personal income levels and the average per capita consumption of water. This is due to several reasons, including larger residential lots in areas with high income levels, the increased use of household appliances in high income areas which consume large quantities of water, and a lack of concern for the size of water bills when consumers are in the higher income brackets.

In 1950, 71.8 per cent of the families in the United States had incomes of less than $5,000 per year, and by 1954, this had decreased to 58.2 per cent. This trend, evident in the period 1950-54, has been continuing in the United States throughout the last 50 years. The Committee for Economic Development* has estimated that by 1975 the disposable income of the average family, after payment of all taxes, would be about $7,100, expressed in dollars of 1956 purchasing power. This represents an increase of 34 per cent over the 1956 average family disposable income of $5,300. This trend was assumed to continue and, as part of the over-all economic assumptions made

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* "Economic Growth in the United States, Its Past and Future" February, 1958, by the Research and Policy Committee of the Committee for Economic Development.

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Selling Price of Water. Within the range of values of water use found in the various cities studied, cost of water generally did not appear to have any noticeable effect on use. However, it was found that, following an increase in water charges, usage was temporarily reduced. It was also noted that, after a period of time, the per capita use rose to equal or exceed the previous rate. In areas receiving a flat-rate type of water service (unmetered), the rate of usage is generally higher than in metered areas, indicating that there may be an upper limit on unit water use where cost is not a factor. However, it was assumed that water service would be on a metered basis throughout the investigational area with the resulting unit water use being less than any upper limit.

Industrial Water Use. The average industrial use of water per acre is about three times greater than unit use per acre in residential areas. However, some industries using water for processing goods have extremely high ranges of water use, which exceed, in some cases, 1,000 acre-feet per acre, while those industries wherein the only use of water is for utility and sanitary purposes have quite low rates of water use.

The data collected on urban water usage includes data from cities having little or no industry as well as from cities containing high levels of industrial development. In analyzing these data, it was observed that, in general, the degree of industrialization does not materially affect the range of per capita water consumption which reflects all uses within the urban areas. This is apparently a result of the dilution of the effect of industrial water use in cities such as Los Angeles, Pasadena, and Glendale, by the large amount of domestic water deliveries coupled with the absence of extremely high water-using industrial plants. As these conditions are expected to prevail in the future throughout all urban areas in the southern California area, industrial water use may be treated as a part of the over-all urban water use in projecting units of use. The projected units of use become more accurate as the area for which the projections are being made becomes sufficiently large so that it contains a well developed, diversified economy. As most of the study units and subunits thereof analyzed in this study are considered to contain or develop such an economy, the projections of unit urban water use were based on the assumption that no unusual effects of localized industrial development on unit water consumption need be projected. Thus, the projected urban water requirements include the amounts necessary for future industrial developments.

Projection of Unit Urban Water Use

After analyzing all the parameters affecting unit urban water use, as discussed in the preceding paragraphs, and reviewing the available technical literature on the subject, the historical trends in unit urban water use were projected to the year 2020. The historical data on unit urban water use, covering a base period from 1930 to 1955, were used in developing a weighted average trend for each temperature zone.

Computation of Historical Trend. The weighted average unit urban water use in each temperature zone was calculated for the years 1930 and 1955. Average rates of water use by each city in the temperature zone were obtained for these years by averaging the rates for the three years nearest the date desired. By this procedure, any irregularities in urban water deliveries due to variations in the weather were minimized. These average rates were then divided by the population of each city at the respective times, resulting in the unit urban water use in each city. The unit urban water use, by cities, was then divided by the ratio between each city's population and the total population of all the sampled cities in each zone, and the products of this step were added together to produce the weighted average unit urban water use at the particular time.

The derivation of these values for the years 1930 and 1955 are shown for each temperature zone on Tables 34 and 35, and the resulting historical trends are presented on Figure 18. The effect of temperature on unit urban water use may be noted in that the rankings of the zones by increasing rates of unit urban water use is identical with their rankings by mean annual temperatures. Also, the rate of increase in unit urban water use was observed to be least in the zones with the most temperate temperature.

TABLE 34

DERIVATION OF WEIGHTED AVERAGE VALUE OF UNIT URBAN WATER USE BY TEMPERATURE ZONES FOR 1930

City	Average annual values of unit urban water use in gallons per capita per day						1930 population	Per cent of total population by cities	Weighted unit urban water use in gallons per capita per day
	1929	1930	1931	1932	1933	Average			
Coastal Zone									
Anaheim	117	118	117	---	---	117	10,995	0.85	0.99
Los Angeles (City proper)	---	130	132	123	---	128	1,134,000	87.92	112.54
Los Angeles (Harbor)	---	158	140	130	---	142	50,000	3.88	5.43
Oxnard	---	---	154	156	156	155	6,285	0.49	0.76
Santa Ana	---	121	118	---	---	120	30,322	2.35	2.82
Santa Barbara	---	146	127	126	---	133	33,613	2.61	3.47
Santa Maria	---	157	155	---	---	156	7,057	0.55	0.86
Beverly Hills	---	240	257	247	---	248	17,429	1.35	3.35
TOTALS							1,289,701	100.00	130.22
San Fernando and San Gabriel Valleys Zone									
Alhambra	126	127	116	---	---	123	29,472	11.32	13.92
Burbank	---	---	---	---	118	118	16,662	6.40	7.55
Glendale	---	136	138	128	---	134	62,736	24.10	32.29
Los Angeles (San Fernando Valley)	---	146	156	172	---	158	54,000	20.75	32.79
Pasadena	143	141	141	---	---	142	76,086	29.24	41.52
San Fernando	---	---	157	153	---	155	7,567	2.91	4.51
South Pasadena	157	152	142	---	---	150	13,730	5.28	7.92
TOTALS							260,253	100.00	140.50

DERIVATION OF WEIGHTED AVERAGE VALUE OF UNIT URBAN WATER USE BY TEMPERATURE ZONES FOR 1930
(continued)

City	Average annual values of unit urban water use in gallons per capita per day						1930 population	Per cent of total population by cities	Weighted unit urban water use in gallons per capita per day
	1929	1930	1931	1932	1933	Average			
Upper Santa Ana Valley and Antelope-Mojave Zone									
Colton	---	---	141	131	128	133	8,014	8.35	11.11
Pomona	---	118	125	116	---	120	20,804	21.67	26.00
Riverside	---	160	168	160	---	163	29,696	30.94	50.43
San Bernardino	153	162	150	---	---	155	37,481	39.04	60.51
TOTALS							95,995	100.00	148.05

TABLE 35

DERIVATION OF WEIGHTED AVERAGE VALUE OF UNIT URBAN WATER USE BY TEMPERATURE ZONES FOR 1955

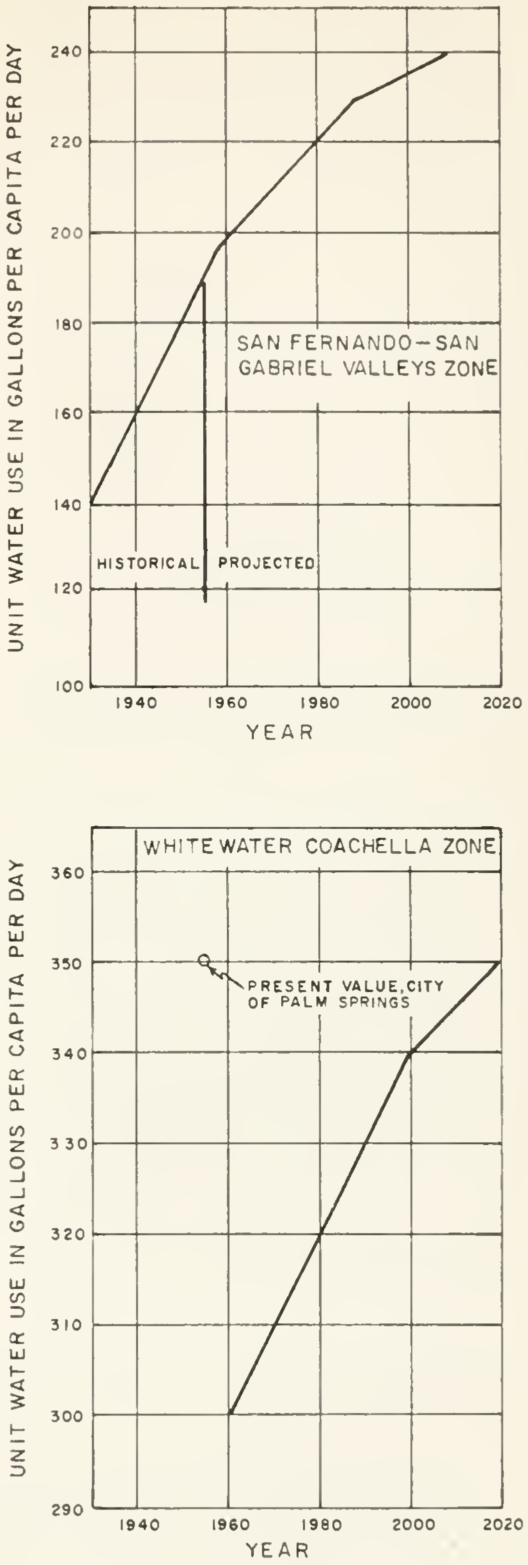
City	Average annual values of unit urban water use in gallons per capita per day					1955 population	Per cent of total population by cities	Weighted unit urban water use in gallons per capita per day
	1953	1954	1955	1956	Average			
Coastal Zone								
Anaheim	163	166	178	---	169	32,000	1.64	2.77
Los Angeles (City proper)	---	154	153	157	155	1,550,000	79.32	122.95
Los Angeles (Harbor)	---	218	222	226	222	100,000	5.12	11.37
Inglewood	143	139	136	---	139	53,400	2.73	3.79
Oxnard	---	175	163	176	171	27,650	1.42	2.43
Santa Ana	---	140	136	139	138	63,100	3.23	4.46
Santa Barbara	149	152	---	---	151	52,500	2.68	4.05
Santa Maria	---	185	183	---	184	13,120	0.67	1.23
Whittier	---	177	182	185	181	31,660	1.62	2.95
Beverly Hills	---	250	257	261	256	30,760	1.57	4.02
TOTALS						1,954,190	100.00	160.02
San Fernando and San Gabriel Valleys Zone								
Alhambra	---	150	148	149	149	54,760	5.59	8.33
Burbank	---	224	214	216	218	92,500	9.44	20.58
Glendale	---	178	180	190	183	114,210	11.65	21.44
Los Angeles (San Fernando Valley)	---	186	179	201	189	540,000	55.10	104.14
Monterey Park	---	143	130	138	137	27,480	2.80	7.95
Pasadena	192	196	190	---	193	116,280	11.87	22.79
San Fernando	---	144	168	---	156	15,350	1.57	2.45
South Pasadena	---	158	147	160	155	19,390	1.98	3.07
TOTALS						979,970	100.00	190.75

DERIVATION OF WEIGHTED AVERAGE VALUE OF UNIT URBAN WATER USE BY TEMPERATURE ZONES FOR 1955

(continued)

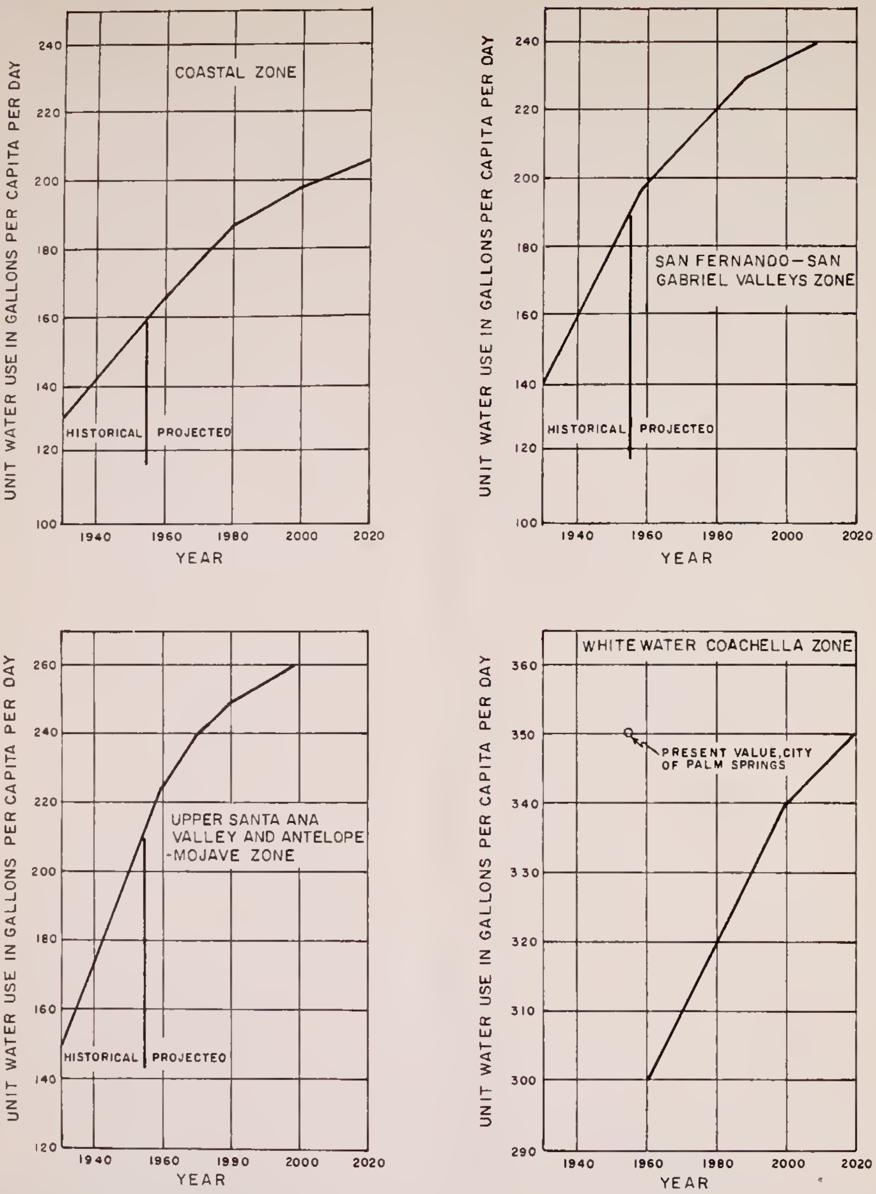
City	Average annual values of unit urban water use in gallons per capita per day					1955 population	Per cent of total population by cities	Weighted unit urban water use in gallons per capita per day
	1953	1954	1955	1956	Average			
Upper Santa Ana Valley and Antelope-Mojave Zone								
Colton	---	248	270	263	260	17,500	6.40	16.64
Lancaster	---	---	153	150	152	14,850	5.43	8.25
Palmdale	---	188	183	190	187	7,500	2.75	5.14
Pomona	---	181	184	199	188	48,250	17.65	33.18
Riverside	---	223	226	237	229	65,820	24.07	55.12
San Bernardino	---	212	211	221	215	82,500	30.17	64.87
Ontario	---	202	213	214	210	37,000	13.53	28.41
TOTALS						273,420	100.00	211.61

FIGURE 18



IT VALUES OF URBAN WATER USE
CALIFORNIA AREAS

FIGURE 18



HISTORICAL AND PROJECTED UNIT VALUES OF URBAN WATER USE FOR SOUTHERN CALIFORNIA AREAS

Projected Unit Urban Water Use. The historical trends were extrapolated through the 60-year study period only after the net effect of the factors previously analyzed was appraised and reasonable modifications to the historical rates of increase were derived. The projected values of unit urban water use are as shown on Figure 18 and on Table 36. In addition to the projections made for the three temperature zones, Table 36 includes forecasts of unit urban water use made for areas in San Diego County as reported in Bulletin No. 61, the Whitewater-Coachella Service Area, and the Kern County Service Area.

Due to the paucity of historical data in the Whitewater-Coachella Service Area, the forecast of unit urban water use was based on the present water consumption in the City of Palm Springs of 350 gallons per capita per day, and the rates of unit urban water use were projected as increasing from 300 gallons per capita per day to this latter value by the year 2020. In the Kern County Service Area, many of the present urban water systems are operating on a flat rate basis, including service in the City of Bakersfield, and the projections of unit urban water use assume all metered services. Accordingly, it was necessary to make adjustments to the historical data in this area in deriving the forecast.

Projected Unit Urban Water Use. The historical trends were extrapolated through the 60-year study period only after the net effect of the factors previously analyzed was appraised and reasonable modifications to the historical rates of increase were derived. The projected values of unit urban water use are as shown on Figure 18 and on Table 36. In addition to the projections made for the three temperature zones, Table 36 includes forecasts of unit urban water use made for areas in San Diego County as reported in Bulletin No. 61, the Whitewater-Coachella Service Area, and the Kern County Service Area.

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TABLE 36

PROJECTED AVERAGE UNIT VALUES OF URBAN WATER USE IN SELECTED AREAS[a]

Year	Coastal Zone – San Luis Obispo, Santa Barbara Ventura and Orange Counties, Coastal Plain of Los Angeles County		San Fernando and San Gabriel Valleys Zone		Upper Santa Ana Valley and Antelope-Mojave Zone		Whitewater-Coachella Service Area		Metropolitan San Diego Area[b]		Remainder of Coastal San Diego County[b]		Kern County Service Area	
	Gallons per capita per day	Acre-feet per capita per year	Gallons per capita per day	Acre-feet per capita per year	Gallons per capita per day	Acre-feet per capita per year	Gallons per capita per day	Acre-feet per capita per year	Gallons per capita per day	Acre-feet per capita per year	Gallons per capita per day	Acre-feet per capita per year	Gallons per capita per day	Acre-feet per capita per year
1960	166	0.186	198	0.222	225	0.252	300	0.336	140	0.157	190	0.212	225	0.253
1970	176	.197	210	.235	240	.269	310	.347	154	.173	200	.224	270	.304
1980	186	.208	220	.246	250	.280	320	.358	168	.188	200	.224	290	.326
1990	192	.215	230	.258	255	.286	330	.370	182	.204	200	.224	308	.345
2000	198	.222	235	.263	260	.291	340	.381	196	.220	200	.224	322	.361
2010	202	.226	240	.269	260	.291	345	.386	200	.224	200	.224	340	.380
2020	206	.231	240	.269	260	.291	350	.392	200	.224	200	.224	344	.385

a. The values in this table represent all uses in urban areas, and include estimated losses within local distribution systems.

b. These values taken from Department of Water Resources Bulletin No. 61.

A principal objective in these forecasts was that the projected values must be reasonable and conservative. As an indication of the fulfilling of this objective, the maximum values of unit urban water use in each area, as projected, are approximately equal to existing values in one or more of the sampled cities in the respective areas. The United States Department of Commerce, in its Business Service Bulletin No. 136, dated January, 1956, estimated that the average United States urban water usage would increase from 155 gallons per capita per day in 1955 to approximately 200 gallons per capita per day by 1975. As may be seen, this rate of increase which is projected for the nation is considerably greater than the rates projected in this report.

Projection of Net Unit Urban Water Use

Estimates were derived of the present and probable future ratios of consumptive use to applied water in urban areas. These ratios were developed through an analysis of each subunit and through application of data reported in State Water Resources Board Bulletin No. 2. The resulting ratios varied from 50 per cent for completely residential areas to 42 per cent for areas containing a land usage pattern of industrial, commercial, and residential areas in economic balance. That portion of the applied water which was not consumptively used was then analyzed by subunits to determine its availability for recapture.

This necessitated consideration of the geologic structure underlying each subunit as well as the existing and probable future procedures for disposal of urban wastes. That portion of the urban water applied to lawns, shrubbery, and landscaping which is not lost by evapo-transpiration and thus percolates below the root zones may enter ground water basins in areas with underlying pervious material. Under these conditions, all of the applied water that was not consumptively used was assumed to be available for re-use. However, in such areas which are presently sewered, or which are expected to be, it was estimated that only 10 per cent of the applied water would be available for re-use. In areas which are underlain by impervious materials and not tributary to a free ground water basin, percolation cannot occur and all of the applied water was assumed to be consumptively used or unavailable for re-use.

Most of the urban centers along the coast, from Santa Barbara to San Diego, are connected to outfall sewers conveying much of the waste products of urban culture to the ocean for disposal. Even inland cities in Los Angeles and Orange Counties are now connected to these ocean disposal systems. With continued urbanization as forecast in Chapter III, many areas which are not now connected to ocean outfall sewers will very likely be sewered in the future. This will probably occur in the inland valleys, such as the Upper Santa Ana Valley, as there is a sharp awareness of the coming necessity for ocean disposal of sewage plant effluent in these areas. During the course of investigation, a survey of informed opinion in the Upper Santa Ana Valley was made and used in estimating the timing of construction and the build-up in use of an ocean outfall sewer from this valley. Similarly, estimates of time of initial construction and build-up in use of ocean outfall sewers were made for other areas.

Based upon these analyses, values of net unit urban water use were derived for each subunit in a manner similar to that presented in Tables 37, 38, and 39, for typical areas in the southern California area. Table 40 presents these values for each subunit by decades to the year 2020 in terms of gallons per capita per day and Table 41 presents the same data in terms of acre-feet per capita per year.

TABLE 37

DERIVATION OF FUTURE VALUES OF NET UNIT URBAN WATER USE FOR COASTAL RIVERSIDE AND SAN BERNARDINO COUNTIES

Year	Unit urban water use		Effect of ocean outfall sewer				Net unit urban water use		
			Area not connected	Area connected	0.42x column (3)[a]	0.90x column (4)[b]			
	Gallons per capita per day (1)	Acre-feet per capita per year (2)	Per cent of total (3)	Per cent of total (4)	Per cent (5)	Per cent (6)	Per cent of urban water (7)[c]	Gallons per capita per day (8)	Acre-feet per capita per year (9)
1960	225	0.252	100	0	42	0	42	95	0.106
1970	240	.269	100	0	42	0	42	101	.113
1980	250	.280	100	0	42	0	42	105	.118
1990	255	.286	62	38	26	34	60	153	.172
2000	260	.291	20	80	8	72	80	208	.233
2010	260	.291	0	100	0	90	90	234	.262
2020	260	.291	0	100	0	90	90	234	.262

a. Portion of urban water consumptively used in areas which are not connected to ocean outfall sewers and are tributary to free ground water basins is estimated to be 42 per cent.

b. Portion of urban water discharged through ocean outfall sewer and consumptively used in urban areas tributary to free ground water basins is estimated to be 90 per cent.

c. Column 7 is sum of columns 5 and 6.

TABLE 38

DERIVATION OF FUTURE VALUES OF NET UNIT URBAN WATER USE FOR SANTA MARIA, OJAI AND SANTA CLARA RIVER VALLEYS

	Unit urban water use		Effect of ocean outfall sewer				Net unit urban water use		
			Area not connected	Area connected	0.42x column (3)[a]	0.90x column (4)[b]			
Year	Gallons per capita per day (1)	Acre-feet per capita per year (2)	Per cent of total (3)	Per cent of total (4)	Per cent (5)	Per cent (6)	Per cent of urban water (7)[c]	Gallons per capita per day (8)	Acre-feet per capita per year (9)
1960	166	0.186	100	0	42	0	42	70	0.078
1970	167	.197	100	0	42	0	42	74	.083
1980	186	.208	100	0	42	0	42	78	.087
1990	192	.215	62	38	26	34	60	115	.129
2000	198	.222	20	80	8	72	80	158	.178
2010	202	.226	0	100	0	90	90	182	.203
2020	206	.231	0	100	0	90	90	185	.208

a. Portion of applied water consumptively used in urban areas which are not connected to ocean outfall sewers and tributary to free ground water basins is estimated to be 42 per cent.

b. Portion of applied water discharged through ocean outfall sewer and consumptively used in urban areas tributary to free ground water basin is estimated to be 90 per cent.

c. Column 7 is sum of columns 5 and 6.

TABLE 39

DERIVATION OF FUTURE VALUES OF NET UNIT URBAN WATER USE FOR OXNARD PLAIN IN VENTURA COUNTY, SOUTH COASTAL SANTA BARBARA COUNTY, AND WEST BASIN IN LOS ANGELES COUNTY[a]

Year	Unit urban water use		Net unit urban water use		
	Gallons per capita per day (1)	Acre-feet per capita per year (2)	Per cent of urban water (3)[b]	Gallons per capita per day (4)	Acre-feet per capita per year (5)
1960	166	0.186	100	166	0.186
1970	176	.197	100	176	.197
1980	186	.208	100	186	.208
1990	192	.215	100	192	.215
2000	198	.222	100	198	.222
2010	202	.226	100	202	.226
2020	206	.231	100	206	.231

a. Excluding Oxnard Forebay and area tributary thereto.

b. Total urban area is assumed to overlie soils with low permeability allowing no re-use of return flows, therefore, connection to ocean outfall sewer has no effect on water requirements. Return flows percolating to the deep aquifers are considered to be insignificant when compared with to total water requirements.

TABLE 40

PROJECTED VALUES OF NET UNIT URBAN WATER USE[a]

(In gallons per capita per day)

Area	1960	1970	1980	1990	2000	2010	2020
San Luis Obispo Service Area							
Subunits 1, 13, 14, 16, 18	166	176	186	192	198	202	206
Subunit 17	70	74	78	115	158	182	185
Subunit 2 through 12, 19, 21	70	74	78	81	83	85	87
Santa Barbara Service Area							
Subunits 26,33 through 39	166	176	186	192	198	202	206
Subunits 22, 29	70	74	78	115	158	182	185
Subunits 23, 30	70	74	78	81	119	162	185
Subunits 24, 25, 27, 28, 31, 32	70	74	78	81	83	85	87
Ventura County Service Area							
Subunits 42 (West of Foster Park), 43 (Oxnard Plain), 44 (Conejo and Oxnard Plain), 48	166	176	186	192	198	202	206
Subunits 42 (East of Foster Park), 43 (Except Oxnard Plain)	70	74	78	115	158	182	185
Subunit 44 (Las Posas and Santa Rosa)	70	74	78	81	119	162	185
Subunit 44 (Simi Valley)	70	74	78	81	83	121	165
Subunits 46, 47	70	74	78	81	83	85	87
Southern California Coastal Plain And Coastal San Diego County Service Area							
Los Angeles County							
Subunits 61 (San Fernando Valley), 62 through 67, 75, 76	178	189	198	207	212	216	216
Subunits 61 (Coastal Plain), 68 through 73, 74 (Pressure Area)	166	176	186	192	198	202	206
Subunit 74 (Montebello Forebay)	149	158	167	173	178	182	185
Subunit 59	70	74	78	115	158	182	185

PROJECTED VALUES OF NET UNIT URBAN WATER USE[a]
(continued)

(In gallons per capita per day)

Area	1960	1970	1980	1990	2000	2010	2020
Orange County							
Subunits 77, 78, 79, 80 (Pressure Area), 81 through 84	166	176	186	192	198	202	206
Subunit 80 (Nonpressure Area)	149	158	167	173	178	182	185
Riverside and San Bernardino Counties							
Subunits Upper Santa Ana Basin	95	101	105	153	208	234	234
San Diego County							
Subunits Metropolitan San Diego Area	140	154	168	182	196	200	200
Subunits Remainder of Coastal San Diego County	190	200	200	200	200	200	200
Antelope-Mojave Service Area	95	101	105	107	109	109	109
Whitewater-Coachella Service Area							
Subunits 169, 170, 171	126	130	134	139	143	145	147
Subunit 172	300	310	320	330	340	345	350
Kern County Service Area	225	271	291	308	322	339	344

---

a. Net unit urban water use - the water measured at the input to a municipal system needed to provide for all beneficial uses and for all irrecoverable losses incidental to such uses for existing or estimated conditions at the point in time under study, expressed on a unit per capita basis.

TABLE 41

PROJECTED VALUES OF NET UNIT URBAN WATER USE[a]

(In acre-feet per capita per year)

Area	1960	1970	1980	1990	2000	2010	2020
San Luis Obispo Service Area							
Subunits 1, 13, 14, 16, 18	0.186	0.197	0.208	0.215	0.222	0.226	0.231
Subunit 17	.078	.083	.087	.129	.178	.203	.208
Subunit 2 through 12, 19, 21	.078	.083	.087	.090	.093	.095	.097
Santa Barbara Service Area							
Subunits 26, 33 through 39	.186	.197	.208	.215	.222	.226	.231
Subunits 22, 29	.078	.083	.087	.129	.178	.203	.208
Subunits 23, 30	.078	.083	.087	.090	.133	.181	.208
Subunits 24, 25, 27, 28, 31, 32	.078	.083	.087	.090	.093	.095	.097
Ventura County Service Area							
Subunits 42 (West of Foster Park), 43 (Oxnard Plain), 44 (Conejo and Oxnard Plain), 48	.186	.197	.208	.215	.222	.226	.231
Subunits 42 (East of Foster Park), 43 (Except Oxnard Plain)	.078	.083	.087	.129	.178	.203	.208
Subunit 44 (Las Posas and Santa Rosa)	.078	.083	.087	.090	.133	.181	.208
Subunit 44 (Simi Valley)	.078	.083	.087	.090	.093	.136	.185
Subunits 46, 47	.078	.083	.087	.090	.093	.095	.097
Southern California Coastal Plain And Coastal San Diego County Service Area							
Los Angeles County							
Subunits 61 (San Fernando Valley) 62 through 67, 75, 76	.200	.212	.221	.232	.237	.242	.242
Subunits 61 (Coastal Plain), 68 through 73, 74 (Pressure Area)	.186	.197	.208	.215	.222	.226	.231
Subunit 74 (Montebello Forebay)	.167	.177	.187	.194	.200	.204	.208
Subunit 59	.078	.083	.087	.129	.178	.203	.208

PROJECTED VALUES OF NET UNIT URBAN WATER USE[a]
(continued)

(In acre-feet per capita per year)

Area	1960	1970	1980	1990	2000	2010	2020
Orange County							
Subunits 77, 78, 79, 80 (Pressure Area), 81 through 84	0.186	0.197	0.208	0.215	0.222	0.226	0.231
Subunit 80 (Nonpressure Area)	.167	.177	.187	.194	.200	.204	.208
Riverside and San Bernardino Counties							
Subunits Upper Santa Ana Basin	.106	.113	.118	.172	.233	.262	.262
San Diego County							
Subunits Metropolitan San Diego Area	.157	.173	.188	.204	.220	.224	.224
Subunits Remainder of Coastal San Diego County	.212	.224	.224	.224	.224	.224	.224
Antelope-Mojave Service Area	.106	.113	.118	.120	.122	.122	.122
Whitewater-Coachella Service Area							
Subunits 169, 170, 171	.132	.141	.147	.150	.154	.154	.154
Subunits 172	.315	.336	.350	.358	.366	.366	.366
Kern County Service Area	.253	.304	.326	.345	.361	.380	.385

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a. Net unit urban water use - the water measured at the input to a municipal system needed to provide for all beneficial uses and for all irrecoverable losses incidental to such uses for existing or estimated conditions at the point in time under study, expressed on a unit per capita basis.

Net Urban Water Requirements

Projected net urban water requirements were derived by application of the values of net unit urban water use, as tabulated in Tables 40 and 41, to the population projections by subunits. The resulting net urban water requirements for service areas in the southern California area are set forth in Table 42.

As previously stated, unit water requirements are frequently stated on an acre-foot per acre basis. To provide a means of comparison between the results of this investigation, based on population, and others which have been made on an areal basis, the net urban water requirements as presented in Table 42 were divided by the projected urban land requirements as presented in Table 23 in Chapter III. These calculated values of net unit urban water use in terms of acre-feet per acre per annum are presented in Table 43.

TABLE 42

PROJECTED NET URBAN WATER REQUIREMENTS IN SOUTHERN CALIFORNIA SERVICE AREAS

(In acre-feet per annum)

Year	Kern County	Southern California Coastal Plain and Coastal San Diego County	Present Service Area Metropolitan Water District	Ventura County	Whitewater-Coachella	Antelope-Mojave	Santa Barbara	San Luis Obispo
1960	50,000	1,539,000	1,365,000	25,000	12,000	17,000	21,000	8,000
1970	79,000	2,239,000	1,976,000	43,000	21,000	37,000	31,000	11,000
1980	103,000	2,911,000	2,544,000	67,000	34,000	86,000	43,000	17,000
1990	139,000	3,490,000	2,986,000	111,000	55,000	143,000	62,000	31,000
2000	198,000	4,119,000	3,465,000	193,000	81,000	197,000	93,000	59,000
2010	280,000	4,601,000	3,822,000	275,000	112,000	238,000	132,000	97,000
2020	365,000	4,927,000	4,078,000	362,000	135,000	271,000	178,000	135,000

TABLE 43

DERIVED VALUES OF NET UNIT URBAN WATER USE

(In acre-feet per acre per annum)

Area	1960	1970	1980	1990	2000	2010	2020
San Luis Obispo Service Area	0.5	0.6	0.8	1.0	1.4	1.7	1.8
Santa Barbara Service Area	1.3	1.3	1.3	1.4	1.5	1.5	1.5
Ventura County Service Area	0.9	1.1	1.4	1.6	1.9	2.1	2.3
Southern California Coastal Plain and Coastal San Diego County Service Area							
Los Angeles County	1.6	1.8	2.0	2.1	2.2	2.2	2.3
Orange County	1.5	1.8	2.0	2.1	2.2	2.4	2.5
San Diego County	2.1	2.1	2.2	2.2	2.2	2.1	2.1
Riverside County	0.7	0.8	1.0	1.5	2.2	2.6	2.7
San Bernardino County	0.7	0.8	1.0	1.5	2.2	2.6	2.6
Kern County Service Area	1.5	1.8	1.9	2.2	2.4	2.6	2.7
Antelope-Mojave Service Area	0.7	0.8	0.9	0.9	0.9	0.9	0.9
Whitewater-Coachella Service Area	1.0	1.1	1.3	1.4	1.5	1.6	1.7

Unit Irrigation Water Use

For many years, the Department of Water Resources has compiled data, made field investigations, and studied unit values of water use for various crops climatically adapted to the investigational area. Unit values, both of consumptive use of applied irrigation water and of total applied water, were obtained from these prior data as published in State Water Resources Board Bulletins No. 2, 12, 15, and 18, for the various subunits and are tabulated on Table 44.

In areas where return flows from applied irrigation water would not be recovered for re-use, unit values of total applied water were utilized. In areas overlying unconfined ground water basins, where excess irrigation application would return to the underground basins and be available for re-use, water requirements were based on estimates of consumptive use of applied water.

In portions of the unconfined ground water basins situated in the Kern County Service Area, the moisture content of the dewatered zone was found to be well below the value of specific retention. Specific retention is the moisture content that the soil is capable of holding against the force of gravity. Where this condition exists, water percolating down from the surface must first increase the moisture content of the soil up to the specific retention before any water can percolate to the zone of usable storage. Percolating water utilized to bring moisture content up to the point of specific retention is not available for future withdrawals.

TABLE 44

ESTIMATED MEAN ANNUAL UNIT VALUES OF WATER USE ON IRRIGATED LANDS

(In feet of depth)

Areas	Alfalfa hay[a]		Irrigated pasture		Citrus subtropical		Deciduous fruits, nuts[b]		Truck crops[c]		Potatoes		Sugar beets		Miscellaneous field crops[d]		Hay and grain		Flowers, nursery	
	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water
San Luis Obispo Service Area																				
Subunits 1, 13 through 19, 21	2.9	1.9	3.5	2.3	---	---	0.9	0.7	3.8	3.0	---	---	1.1	0.8	1.1	0.8	0.1	0.1	---	---
Subunits 2 through 5, 7 through 12	3.7	2.6	3.9	2.7	---	---	1.6	1.3	3.6	2.8	2.3	1.8	1.9	1.3	1.9	1.3	0.6	0.5	---	---
Santa Barbara Service Area																				
Subunits 33 through 39	3.0	2.1	3.0	2.1	1.6	1.3	1.6	1.3	3.4	2.0	---	---	---	---	2.0	1.0	---	---	1.5	1.0
Subunits 22 through 32	2.9	2.3	3.1	2.3	1.6	1.3	1.9	1.5	4.6	3.0	2.3	1.5	1.4	1.0	1.4	1.0	0.7	0.5	---	---
Ventura County Service Area																				
Subunits 42, 43 (portion), 46	3.0	2.1	3.0	2.1	1.5	1.3	1.7	1.6	2.8	2.0	---	---	1.8	1.1	1.8	1.1	0.9	0.6	4.3	3.0
Subunits 43 (portion), 44, 47, 48	2.7	2.4	3.5	2.4	1.6	1.4	1.8	1.6	3.2	2.4	---	---	---	---	1.6	1.2	1.1	0.8	4.3	3.0
Southern California Coastal Plain and Coastal San Diego County																				
Los Angeles County																				
Subunits 58 through 76	3.4	2.4	3.6	2.5	2.1	1.5	2.1	1.5	3.4	2.4	---	---	1.7	1.2	1.7	1.2	1.0	0.7	---	---
Orange County																				
Subunits 77 through 84	3.4	2.4	3.6	2.5	2.1	1.5	2.1	1.5	3.4	2.4	---	---	1.7	1.2	1.7	1.2	1.0	0.7	---	---
Riverside County																				
Subunits 133 through 156	4.7	2.8	4.7	2.8	2.7	1.6	2.2	1.3	2.2	1.3	2.2	1.3	---	---	1.4	0.7	1.0	0.6	---	---
San Bernardino County																				
Subunits 157 through 166	3.5	2.1	3.5	2.1	2.5	1.5	2.2	1.3	2.2	1.3	2.2	1.3	---	---	1.4	0.7	0.8	0.5	---	---
San Diego County																				
Subunits 85 through 101, 106 through 110	3.5	2.4	3.5	2.4	2.4	1.4	3.1	1.9	5.0	3.0	---	---	---	---	2.4	1.4	0.7	0.4	3.3	2.0
Subunits 102 through 105, 111, 117, 119, 120, 125	3.6	2.5	3.6	2.5	2.5	1.5	3.0	1.8	4.7	2.8	---	---	---	---	2.5	1.5	0.8	0.5	3.3	2.0

ESTIMATED MEAN ANNUAL UNIT VALUES OF WATER USE ON IRRIGATED LANDS
(continued)

(In feet of depth)

Areas	Alfalfa hay[a]		Irrigated pasture		Citrus subtropical		Deciduous fruits, nuts[b]		Truck crops[c]		Potatoes		Sugar beets		Miscellaneous field crops[d]		Hay and grain		Flowers, nursery	
	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water	Applied water	Consumptive use of applied water
Kern County Service Area																				
Subunits 49 through 57	3.9	3.1	4.4	3.1	2.9	2.3	2.9	2.3	1.8	1.0	3.0	1.5	2.9	2.0	2.3	1.6	1.1	0.8	---	---
Antelope-Mojave Service Area																				
Subunits 173 through 180	6.0	3.0	5.6	2.8	---	---	4.4	2.2	2.8	1.4	2.9	1.4	---	---	4.0	2.0	1.6	0.8	---	---
Subunits 181 through 186	5.6	2.8	5.4	2.7	---	---	4.2	2.1	3.0	1.5	---	---	---	---	4.4	2.2	1.8	0.9	---	---

a. Unit use of water by alfalfa seed in (1) Kern County Service is 3.2 and 2.6 feet for applied water and consumptive use of applied water, respectively, (2) Antelope-Mojave Service Area, same as alfalfa hay.

b. Unit use of water by grapes in the Kern County Service Area, 3.1 and 2.5, respectively, for applied water and consumptive use of applied water.

c. Double-cropping of truck crops assumed in all areas with the exception of the Kern County and Antelope-Mojave Service Areas.

d. Excluding unit use of water by cotton in Kern County Service Area of 2.7 and 2.3 feet, respectively, for applied water and consumptive use of applied water.

Quantities of water required in this area to prime the moisture-deficient zone above the water table to a moisture content equivalent to specific retention are large. The time required to prime this portion of the basin through incidental recharge resulting from unavoidable percolation of excess irrigation application will be great, probably extending well beyond the amortization period of the project. Consequently, the demand for project water in areas so affected was assessed on the basis of required application rather than consumptive use.

Agricultural Water Requirements

Appropriate unit values of water use, as tabulated on Table 44, were applied to projected acreages of irrigated land to obtain the net agricultural water requirements. These water requirements for service areas in the southern California area are presented in Table 45.

TABLE 45

PROJECTED REQUIREMENTS FOR WATER BY IRRIGATED AGRICULTURE IN SOUTHERN CALIFORNIA SERVICE AREAS[a]

(In acre-feet per annum)

Year	Kern County	Southern California Coastal Plain and Coastal San Diego County	Ventura County	Present Service Area Metropolitan Water District	Antelope-Mojave	Santa Barbara	San Luis Obispo
1960	896,000	519,000	182,000	412,000	216,000	143,000	46,000
1970	1,174,000	494,000	186,000	395,000	209,000	145,000	52,000
1980	1,644,000	445,000	165,000	338,000	190,000	170,000	72,000
1990	2,072,000	458,000	143,000	339,000	160,000	183,000	103,000
2000	2,220,000	468,000	126,000	329,000	110,000	183,000	104,000
2010	2,148,000	459,000	97,000	308,000	87,000	188,000	99,000
2020	2,092,000	454,000	78,000	280,000	68,000	188,000	90,000

a. Agricultural water requirements for Whitewater-Coachella area not tabulated.

CHAPTER VI. ECONOMIC DEMAND FOR IMPORTED WATER

The net agricultural and urban water requirements of each subunit, obtained as described in the preceding sections, were added together to obtain the total water requirements of each subunit. As previously mentioned, some local water supplies are now available and/or can be further developed to meet these requirements. The amounts of such supplies were subtracted from the requirements to obtain the supplemental water requirements, if any. Supplemental water requirements may be met either by temporarily overdrawing ground water basins or by importing water, or both. The probabilities and potentialities for continued overdraft in the various ground water basins of southern California were considered in all subunits as a necessary step in estimating the demand for imported water.

To aid in evaluating the probable extent of future overdraft in the principal basins, data were collected on present rates of overdraft; calculations were made of probable future levels of overdraft under the conditions of projected development; the resulting accumulated overdraft was calculated and compared to the storage capacities of the basins; and projected declines in water tables were developed on a reconnaissance basis.

This analysis was further refined in the Kern County Service Area, where the cost of pumped water was estimated for levels of increased pumping lift and compared with the price of imported water. In those portions of the service area blessed with a substantial safe yield of ground water supplies it was assumed that overdraft would continue until pumping costs and import water costs became equalized, after which time pumping would be limited to the safe yield of the ground water basin.

Other factors which affect the projected rate of future overdraft are the historical actions of local agencies in controlling overdraft, court adjudications of water rights in ground water basins, stipulated agreements limiting extractions from ground water basins, artificial recharge of ground water basins combined with taxation policies, and court orders limiting pumping from ground water basins. Depending on the individual conditions, it was estimated that overdraft would continue in certain basins up to 30 years, and in portions of Kern County, would continue throughout year 2020.

Many subunits either do not overlie ground water basins or are over basins which are of insufficient capacity to sustain any extended overdraft. In these areas, all supplemental water requirements must be met by imported water.

The growth in demand for imported water in each subunit was determined upon application of the foregoing considerations. As it is believed that the assumptions made with respect to elimination of ground water overdraft are conservative, the resulting values of demand for imported water are also believed to be conservative.

The principal elements in the calculations of growth in demand for imported water are summarized for the entire investigational area in Table 46. The values of growth in demand for imported water by service areas are tabulated in Table 47 and shown graphically on Figure 19. It should be noted that these values include the demands for surplus northern California water as well as demands which are being met and will be met by water from the Colorado River Aqueduct.

TABLE 46

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN THE SOUTHERN CALIFORNIA AREA

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	1,672,400	2,001,200	3,673,600	2,216,800	1,569,700	611,700
1970	2,461,600	2,259,800	4,721,400	2,378,700	2,429,400	1,426,400
1980	3,260,800	2,685,700	5,946,500	2,438,600	3,567,900	3,020,500
1990	4,030,600	3,118,300	7,148,900	2,457,800	4,736,300	4,415,400
2000	4,941,600	3,211,600	8,153,200	2,484,500	5,701,000	5,408,500
2010	5,735,200	3,078,000	8,813,200	2,497,600	6,332,300	6,129,500
2020	6,373,100	2,968,800	9,341,900	2,499,600	6,831,700	6,684,600

The projections of growth in demand for imported water by service areas are presented in ensuing sections and the principal factors influencing local water requirements are discussed. The Southern California Coastal Plain and Coastal San Diego County Service Area is discussed first. The existing service area of The Metropolitan Water District of Southern California, which includes a major portion of this service area, is then discussed. The growth in demand for imported water in counties and portions of counties located within the area is presented separately, as are these data for areas comprising the remainder of the investigational area.

TABLE 47

HISTORICAL AND PROJECTED ECONOMIC DEMAND FOR IMPORTED WATER[a]

(In thousands of acre-feet per annum)

Area	1950	1960	1970	1980	1990	2000	2010	2020
Coastal San Diego County and Southwestern Riverside County[b]	69.3	136	319	474	659	826	914	993
Present Metropolitan Water District Service Area	69.3	127	289	418	565	695	753	794
Coastal Riverside County[b]	0.0	33	45	60	114	261	405	480
Present Metropolitan Water District Service Area	0.0	33	45	58	109	242	366	426
Coastal San Bernardino County	0.0	8	21	26	154	317	451	519
Present Metropolitan Water District Service Area	0.0	8	21	26	64	135	203	243
Coastal Los Angeles County	60.6	303	662	1,191	1,384	1,484	1,551	1,602
Present Metropolitan Water District Service Area	60.6	303	662	1,067	1,209	1,295	1,349	1,394
Orange County	35.7	132	193	263	352	421	465	511
Present Metropolitan Water District Service Area	35.7	132	193	259	341	395	432	472
TOTALS - PRESENT METROPOLITAN WATER DISTRICT SERVICE AREA[c]	165.6	603	1,210	1,828	2,288	2,762	3,103	3,329
TOTALS - SOUTHERN CALIFORNIA COASTAL PLAIN AND COASTAL SAN DIEGO COUNTY	165.6	612	1,240	2,014	2,663	3,309	3,786	4,105

HISTORICAL AND PROJECTED ECONOMIC DEMAND FOR IMPORTED WATER[a]

(continued)

(In thousands of acre-feet per annum)

Area	1950	1960	1970	1980	1990	2000	2010	2020
Ventura County	0.0	0	10	41	55	115	168	236
TOTALS - SOUTH COASTAL AREA	165.6	612	1,250	2,055	2,718	3,424	3,954	4,341
Santa Barbara Service Area	0.0	0	15	58	93	121	154	196
San Luis Obispo Service Area	0.0	0	0	5	19	28	37	55
TOTALS - SANTA BARBARA AND SAN LUIS OBISPO SERVICE AREAS	0.0	0	15	63	112	149	191	251
Antelope-Mojave Service Area	0.0	0	15	80	142	175	195	208
Whitewater-Coachella Service Area	0.0	0	0	0	35	55	90	100
Kern County Service Area[d]	0.0	0	146	823	1,409	1,606	1,700	1,785
TOTALS - SOUTHERN CALIFORNIA AREA	165.6	612	1,426	3,021	4,416	5,409	6,130	6,685

a. Values include demands for net Colorado River Aqueduct supply amounting to a maximum of 1,150,000 acre-feet annually, but exclude demands for Los Angeles Aqueduct supply of 320,000 acre-feet annually, which is treated herein as part of the local water supply.

b. That portion of Coastal Riverside County that will be served from the San Diego Aqueduct is tabulated with San Diego County.

c. First delivery of Colorado River water to the Metropolitan Water District area occurred in 1941.

d. Values do not include supply from Friant-Kern Canal.

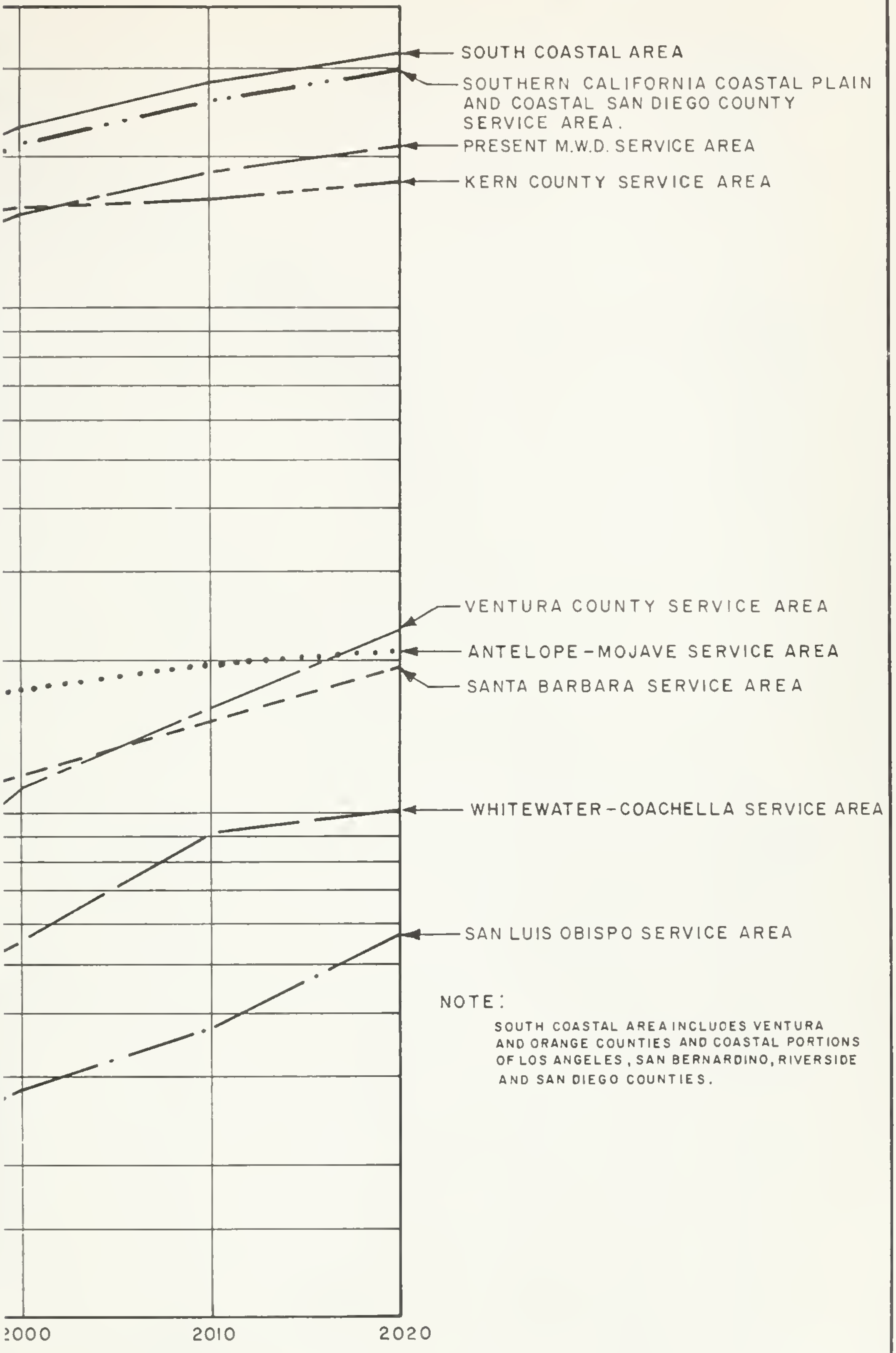
Southern California Coastal Plain and Coastal San Diego County Service Area

This service area includes Orange County and the coastal segments of Los Angeles, San Bernardino, Riverside, and San Diego Counties. It comprises some 9,400 square miles of one of the most highly developed regions of the State, and includes the service area of The Metropolitan Water District of Southern California.

The Los Angeles metropolitan area, which includes Los Angeles and Orange Counties, is the nation's third largest manufacturing and insurance center and the second largest retail trade center. In the first half of 1958, homebuilding continued strong throughout the South Coastal Area, with the Los Angeles, San Diego, and San Bernardino-Riverside-Ontario metropolitan areas being first, sixth, and twelfth, respectively, among the nation's metropolitan areas in volume of housing construction. This housing boom, which resulted from the area's population growth, is only one tangible piece of evidence of the dynamic economy of the South Coastal Area. From 1949 to 1957, the range of manufacturing employment increase in the area's counties varied from a high of 354 per cent in Orange County to a low of 60 per cent in San Bernardino County. The full story of the area's present stature is reflected in the projections made for future growth.

The resulting projections of urban, agricultural, and total net water requirements in the Southern California Coastal Plain and Coastal San Diego County Service Area are shown on Table 34, Chapter V. The total net water requirements were projected to increase from 2,058,000 acre-feet annually in 1960 to 5,380,500 acre-feet in the year 2020. At that time, the area essentially would be fully developed.

FIGURE 19

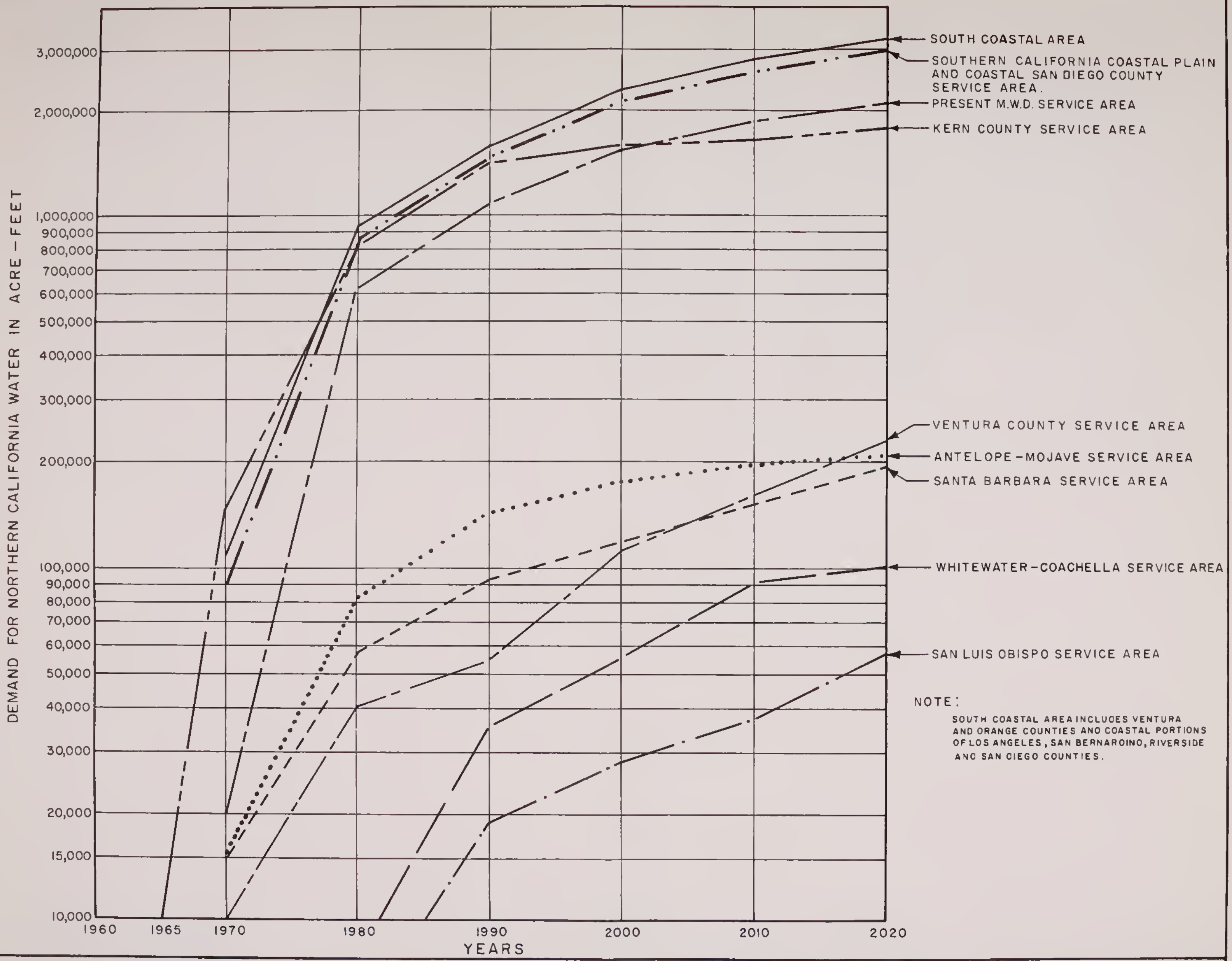


NOTE:

SOUTH COASTAL AREA INCLUDES VENTURA AND ORANGE COUNTIES AND COASTAL PORTIONS OF LOS ANGELES, SAN BERNARDINO, RIVERSIDE AND SAN DIEGO COUNTIES.

RN CALIFORNIA WATER IN SOUTHERN CALIFORNIA AREAS

FIGURE 19



NOTE:

SOUTH COASTAL AREA INCLUDES VENTURA AND ORANGE COUNTIES AND COASTAL PORTIONS OF LOS ANGELES, SAN BERNARDINO, RIVERSIDE AND SAN DIEGO COUNTIES.

PROJECTED GROWTH IN DEMAND FOR SURPLUS NORTHERN CALIFORNIA WATER IN SOUTHERN CALIFORNIA AREAS

DEPARTMENT OF WATER RESOURCES 1959

The safe yield of existing water supply developments in the service area, including an estimated supply of 320,000 acre-feet annually through the Los Angeles Aqueduct, was estimated to be 1,275,000 acre-feet annually. While a small quantity of additional local waters could be economically conserved in San Diego County, it was assumed that the necessary works would not be constructed due to financing problems.

In addition to using the foregoing water supplies and imported supplies from the Colorado River, this service area has been overdrawing its ground water resources to satisfy its water needs. This overdraft has been continuing for several years at a rate of 300,000 to 400,000 acre-feet annually, and was assumed to continue for a time in the future, as is indicated on Table 48 in the difference between growth in demand for imported water and supplemental water requirements.

TABLE 48

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN THE SOUTHERN CALIFORNIA COASTAL PLAIN AND COASTAL SAN DIEGO COUNTY SERVICE AREA

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	1,539,300	518,700	2,058,000	1,275,000	809,800	611,700
1970	2,239,600	494,500	2,734,100	1,275,000	1,482,100	1,240,100
1980	2,911,000	444,700	3,355,700	1,275,000	2,090,000	2,014,000
1990	3,490,600	457,600	3,948,200	1,275,000	2,669,300	2,663,300
2000	4,119,200	468,200	4,587,400	1,275,000	3,308,000	3,309,000
2010	4,601,200	458,600	5,059,800	1,275,000	3,780,600	3,785,600
2020	4,927,000	453,500	5,380,500	1,275,000	4,101,300	4,105,300

The safe yield of existing water supply developments in the service area, including an estimated supply of 320,000 acre-feet annually through the Los Angeles Aqueduct, was estimated to be 1,275,000 acre-feet annually. While a small quantity of additional local waters could be economically conserved in San Diego County, it was assumed that the necessary works would not be constructed due to financing problems.

In addition to using the foregoing water supplies and imported supplies from the Colorado River, this service area has been overdrawing its ground water resources to satisfy its water needs. This overdraft has been continuing for several years at a rate of 300,000 to 400,000 acre-feet annually, and was assumed to continue for a time in the future, as is indicated on Table 48 in the difference between growth in demand for imported water and supplemental water requirements.

TABLE 48

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN THE SOUTHERN CALIFORNIA COASTAL PLAIN AND COASTAL SAN DIEGO COUNTY SERVICE AREA

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	1,539,300	518,700	2,058,000	1,275,000	809,800	611,700
1970	2,239,600	494,500	2,734,100	1,275,000	1,482,100	1,240,100
1980	2,911,000	444,700	3,355,700	1,275,000	2,090,000	2,014,000
1990	3,490,600	457,600	3,948,200	1,275,000	2,669,300	2,663,300
2000	4,119,200	468,200	4,587,400	1,275,000	3,308,000	3,309,000
2010	4,601,200	458,600	5,059,800	1,275,000	3,780,600	3,785,600
2020	4,927,000	453,500	5,380,500	1,275,000	4,101,300	4,105,300

The need for an additional source of water in the area is shown by the values presented in the table, and shown graphically on Figure 19.

The elevation above sea level of the demands for imported water is important in designing project water service facilities. Accordingly, estimates were made of the distribution of year 2020 supplemental water requirements in the service area by 500-foot elevation bands. This distribution is shown on Table 49 by counties and areas. It is seen that about 70 per cent of the total is required below the 1,000-foot elevation contour, while only 3 per cent of the total is required above the 2,000-foot contour.

TABLE 49

ECONOMIC DEMAND FOR IMPORTED WATER BY ELEVATION ZONES IN THE SOUTHERN CALIFORNIA COASTAL PLAIN AND COASTAL SAN DIEGO COUNTY SERVICE AREA IN THE YEAR 2020

(In thousands of acre-feet)

Elevation zones (feet)	Areas						Per cent of total area	Cumulative per centages
	Coastal Los Angeles County	Coastal San Diego County	Coastal San Bernardino County	Orange County	Coastal Riverside County	Total		
Under 500	962	604	0	443	0	2,009	48.9	48.9
500-1,000	370	142	137	42	212	903	22.0	70.9
1,000-1,500	179	61	282	18	208	748	18.2	89.1
1,500-2,000	77	33	61	4	147	322	7.9	97.0
2,000-2,500	12	6	20	2	38	78	1.9	98.9
Over 2,500	2	4	19	2	18	45	1.1	100.0
TOTALS	1,602	850	519	511	623	4,105	100.0	

A discussion of general conditions, factors considered, and assumptions employed in the projections of demand for imported water in component units of the Southern California Coastal Plain and Coastal San Diego County Service Area follows, together with detailed tables of demands for water on a county basis.

Service Area of Metropolitan Water District

The Metropolitan Water District of Southern California serves Colorado River water to its member agencies in Los Angeles, Orange, San Bernardino, Riverside, and San Diego Counties, and comprised some 3,200 square miles in June, 1958. The District's claimed right to waters of the Colorado River is 1,212,000 acre-feet, and it is estimated that the net supply after deducting losses approximates 1,150,000 acre-feet annually. The full capacity of the Colorado River Aqueduct will be available for use by 1960 under the District's present construction program.

Deliveries of Colorado River water by the Metropolitan Water District commenced in 1941, with a relatively slow build-up in water sales until 1950, by which time annual deliveries were about 165,000 acre-feet. Subsequent to that time, District annexations and increasing public awareness of the lowering ground water levels and accompanying intrusion of sea water in coastal basins have resulted in an increase in use of Colorado River water to 540,000 acre-feet in 1957-58, an average increase of 53,000 acre-feet per year during this latter period.

Basic assumptions employed in estimating the rate at which imported water will be used in the present District service area to satisfy water requirements are as follows:

(1) The present patterns of ground water extractions and resulting overdrafts in the ground water basins of Los Angeles and San Gabriel River drainage areas and in the Upper Santa Ana River Basins will continue through 1970, and thereafter will gradually be modified to a level of extractions limited to the safe yields of the basins. The West Coast Basin is now limited by voluntary agreement to extractions about one-fourth greater than the estimated safe yield thereof.

(2) The present practice of artificial recharge of ground water in the Orange County coastal plain using imported water will continue. However, the present practice of purchasing water for the purpose of relieving the accumulated overdraft will continue only until that time between 1965 and 1970 when this accumulated overdraft will be overcome.

(3) The Raymond Basin area will continue the present pattern of ground water extraction as limited by court action.

(4) The long-term local water supply available from San Diego County reservoirs is equal to the estimated safe yield thereof. It is considered that over the long-term period, additional water developed by overdrawing these reservoirs, in conjunction with use of imported water, is of negligible magnitude.

(5) The recent court decision relative to ground water extractions of the cities of Riverside, San Bernardino, Colton, and Redlands will not result in increased use of Colorado River water by reason of purchases of water by those cities not presently in the District.

(6) Other entities within the District will continue their present practice and policies with regard to utilization of ground water and surface water supplies.

Based upon these assumptions, the values of growth in demand for imported water within the Metropolitan Water District were estimated as tabulated on Table 50 and depicted graphically on Figure 20. Table 50 contains the components leading to determination of imported water requirements as previously discussed for the total service area. The demand for imported water includes the demand for Colorado River water. Figure 20 clearly shows this District's future dependence on northern California water.

TABLE 50

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN THE PRESENT AREA OF THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	1,364,800	412,000	1,776,800	1,028,600	756,200	602,500
1970	1,976,400	394,600	2,371,000	1,028,600	1,354,200	1,209,900
1980	2,544,400	337,800	2,882,200	1,028,600	1,863,000	1,827,900
1990	2,986,100	338,700	3,324,800	1,028,600	2,296,100	2,287,800
2000	3,464,700	329,300	3,794,000	1,028,600	2,765,300	2,762,500
2010	3,822,300	308,200	4,130,500	1,028,600	3,101,900	3,103,200
2020	4,077,700	280,100	4,357,800	1,028,600	3,329,200	3,328,800

It is believed that the projected increases of population and irrigated acreage in the District service area will occur regardless of immediate construction of aqueduct facilities from northern California. Moreover, in San Diego County and southwestern Riverside County, agricultural growth will be greatly stimulated during the coming decade by the construction of the Second San Diego Aqueduct. The historical inhibition of growth of irrigated agriculture in these areas resulting from lack of a firm water supply will be removed by the construction of this facility.

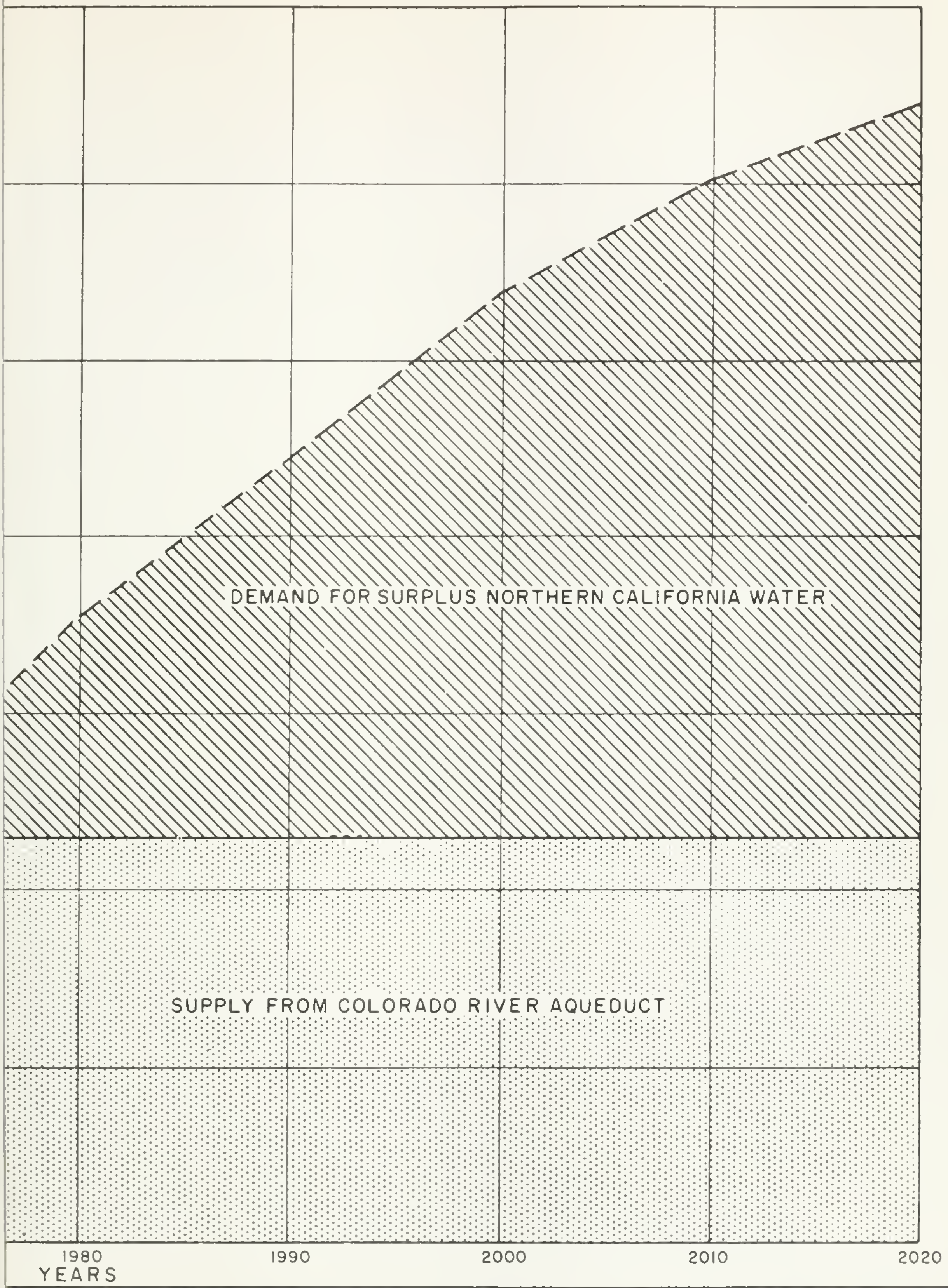
It has been suggested that, upon the completion of the enlargement of Colorado River Aqueduct facilities in 1960, the District operate the aqueduct at full capacity and spread excess water deliveries in the underground. At the time direct demands on the aqueduct equaled the capacity thereof, the water stored in underground basins would be withdrawn and distributed to member agencies. The purpose of this plan would be to provide carry-over water in the event a new source of water supply were not available at the time it was needed.

Analysis of the plan indicates that probably only in the Upper San Gabriel Valley Basin in Los Angeles County and in Chino and Bunker Hill Basins in San Bernardino County is there dewatered storage capacity of a magnitude necessary for the undertaking. Further, there does not exist the legal mechanism at this time by which the plan could be accomplished. Assuming that it could be legally accomplished and disregarding the inherent physical problems, it is estimated that the program would have the net effect by 1970 of maintaining the present conditions of ground water overdraft. In other words, the accumulated ground water overdraft in 1970 would be equivalent to presently existing accumulated overdraft.

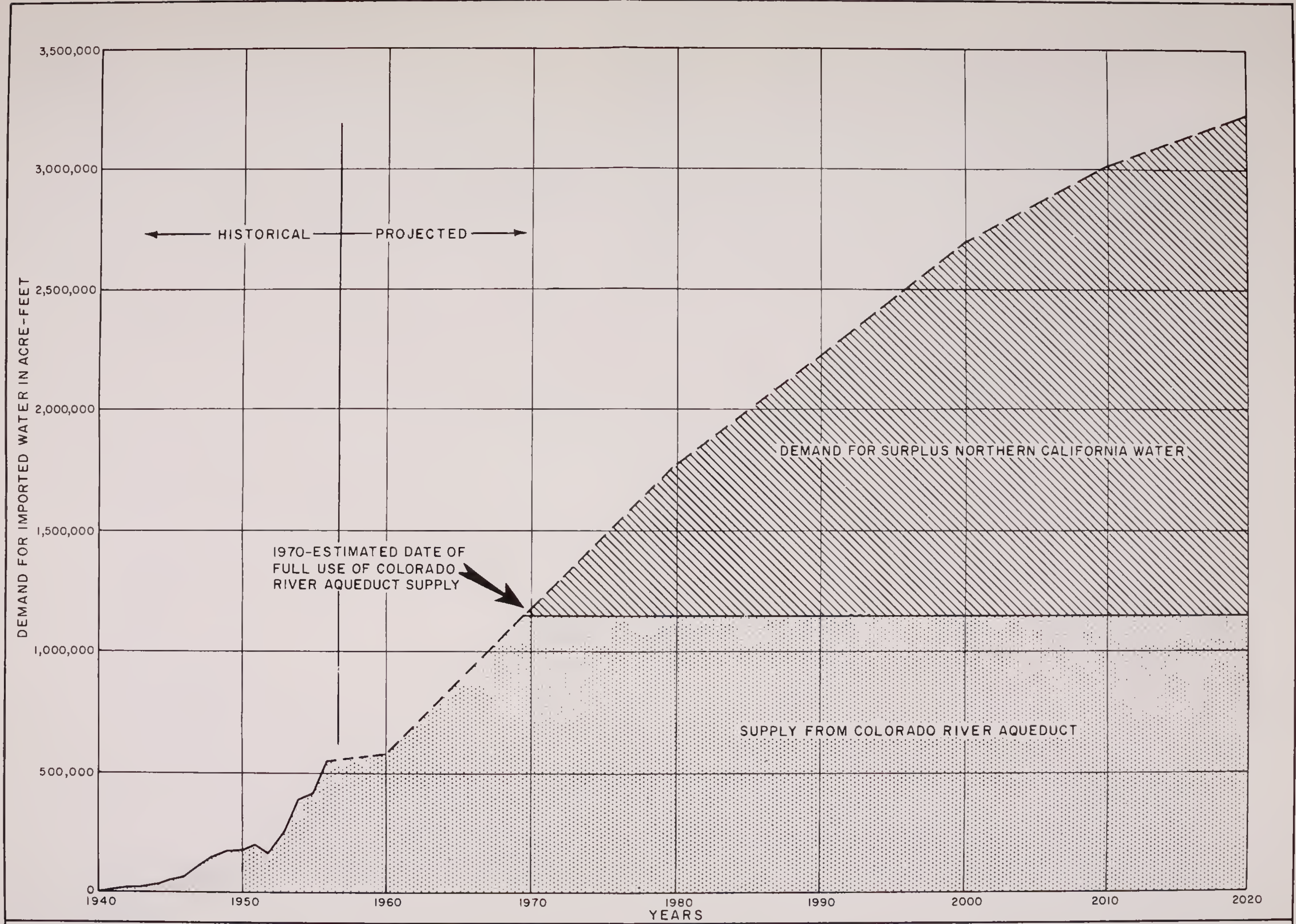
Under the assumptions followed in deriving the imported water demands shown in Table 50, the accumulated overdraft in the District by 1970 would be about 3,000,000 acre-feet greater than at present. Thus, the program if found practicable of accomplishment, is considered highly desirable. However, it does not appear to offer a solution to the water supply problems of the District's area beyond 1970.

Coastal Plain Areas not Presently Served with Imported Water

Highly developed areas in the southern California coastal plain not presently served with imported water include the San Bernardino Valley, San Gabriel Valley, Newhall, and Agoura subunits. With the exception of the Agoura subunit, these areas overlie large permeable ground water basins adjacent to mountain watersheds and have not experienced acute water shortages. Increased use of water in these basins has, however, diminished the supply to downstream basins. The increased utilization of water that will result with projected growth will eventually exceed the local water supplies available thereto and the utilization of imported water will become a necessity.



D WATER IN PRESENT METROPOLITAN WATER DISTRICT SERVICE AREA



HISTORICAL AND PROJECTED GROWTH IN DEMAND FOR IMPORTED WATER IN PRESENT METROPOLITAN WATER DISTRICT SERVICE AREA

DEPARTMENT OF WATER RESOURCES 1959

In the Agoura subunit, water supplies are presently inadequate and rapid urban expansion would be occurring now if an adequate water supply were available.

The growth in economic demand for imported water in these areas was predicated on the following assumptions:

(1) The San Gabriel Valley and Agoura subunits will commence the use of imported water supplies in 1970.

(2) The San Bernardino Valley subunits will commence the use of imported water supplies in 1982.

(3) The Newhall subunit will commence using imported water in 1985.

(4) Overdrafts which may exist at the commencement of taking imported water will be gradually eliminated during the ensuing 10-year interval.

It is recognized that the above-stated dates for initial use of imported water supplies are conservative and physical or legal considerations may make it mandatory that initial use of imported water occur at earlier dates. Use of imported water in advance of the assumed dates, depending on the exact time, would either advance the date when northern California water would be needed in the southern California area or result in a more rapid growth in demand for the water than estimated herein.

Demand for Imported Water by Areas. Net water requirements, local water supplies, supplemental water requirements, and the growth in demand for imported water for counties and portions of counties within which service from the Metropolitan Water District is available are presented in the following paragraphs. The growth in demand for imported water includes demands for water from the Colorado River Aqueduct where applicable.

In the Agoura subunit, water supplies are presently inadequate and rapid urban expansion would be occurring now if an adequate water supply were available.

The growth in economic demand for imported water in these areas was predicated on the following assumptions:

(1) The San Gabriel Valley and Agoura subunits will commence the use of imported water supplies in 1970.

(2) The San Bernardino Valley subunits will commence the use of imported water supplies in 1982.

(3) The Newhall subunit will commence using imported water in 1985.

(4) Overdrafts which may exist at the commencement of taking imported water will be gradually eliminated during the ensuing 10-year interval.

It is recognized that the above-stated dates for initial use of imported water supplies are conservative and physical or legal considerations may make it mandatory that initial use of imported water occur at earlier dates. Use of imported water in advance of the assumed dates, depending on the exact time, would either advance the date when northern California water would be needed in the southern California area or result in a more rapid growth in demand for the water than estimated herein.

Demand for Imported Water by Areas. Net water requirements, local water supplies, supplemental water requirements, and the growth in demand for imported water for counties and portions of counties within which service from the Metropolitan Water District is available are presented in the following paragraphs. The growth in demand for imported water includes demands for water from the Colorado River Aqueduct where applicable.

All of the following tables are summaries of similar data for each subunit making up the larger areas. In several of the areas, apparent incongruities appear in comparing the values in the tables. This is because there may be surpluses of local water supplies in some subunits and shortages in other subunits within the same larger area, with the summation indicating a supplemental water requirement existing simultaneously with surplus local water supplies.

1. Coastal Los Angeles County. These data are summarized on Table 51 for the coastal portion of Los Angeles County. Included in tabulated values of local water supplies is an estimated supply of 320,000 acre-feet annually from the Mono-Owens Basins. The effect of the continuation of urban encroachment on irrigated lands is clearly shown on this table through the early elimination of agricultural water requirements. This continuing trend has resulted in a loss of 100,000 acres of agriculturally productive lands since 1948.

TABLE 51

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN COASTAL LOS ANGELES COUNTY

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	1,183,700	47,700	1,231,400	743,000	501,200	302,700
1970	1,615,200	11,500	1,626,700	743,000	893,500	662,600
1980	1,982,400	2,000	1,984,400	743,000	1,241,400	1,191,000
1990	2,136,800	0	2,136,800	743,000	1,393,800	1,384,000
2000	2,228,000	0	2,228,000	743,000	1,485,000	1,483,900
2010	2,292,700	0	2,292,700	743,000	1,549,700	1,551,000
2020	2,346,100	0	2,346,100	743,000	1,603,100	1,602,400

2. Orange County. Table 52 shows the basic data for Orange County. In similar fashion to Los Angeles, the pattern of water use in Orange County is projected to change from a major portion used for agriculture to none in about 60 years. This will occur as a result of the exploding growth of population on these lands. Loss of one-half of the citrus acreage existing in Orange County in 1940 has already occurred because of population growth.

TABLE 52

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN ORANGE COUNTY

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	124,500	142,600	267,100	153,500	113,600	132,000
1970	253,700	94,200	347,900	153,500	194,400	192,700
1980	385,000	32,200	417,200	153,500	263,800	262,800
1990	486,400	19,600	506,000	153,500	352,400	352,300
2000	567,300	10,700	578,000	153,500	424,400	421,200
2010	617,700	1,400	619,100	153,500	465,600	465,400
2020	664,900	0	664,900	153,500	511,400	511,300

3. Coastal Riverside County. This area includes those Riverside County subunits in the Upper Santa Ana Valley, excluding the Winchester South subunit. Data used in projecting demands for imported water therein are shown on Table 53. The water requirements show very rapid expansion in urban water use, with agricultural use holding its own through the near future. This reflects the continuation of sizable acreages of irrigated agriculture throughout the 60-year study period.

This forecast use of large acreages to grow irrigated crops was based on the following conditions in the area:

(1) A considerable acreage of good irrigable lands (203,000 acres of good valley (V) and hill (H) lands).

(2) A rapid population growth but not sufficient to force agriculture out of existence except in the Western Municipal Water District area. Irrigated acreage is indicated as increasing in the Eastern Municipal Water District area from 32,700 acres in 1957 to 40,500 acres in 2020 because of the availability of good irrigable and habitable lands sufficient for both agricultural and urban growth.

(3) The adaptability of high income producing truck crops, oranges, grapefruit, and deciduous fruits to the area.

(4) Sufficient good land for crop rotations and maintenance of truck crop production in the area.

TABLE 53

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN COASTAL RIVERSIDE COUNTY[a]

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	20,600	122,100	142,700	120,000	35,800	33,000
1970	34,200	110,800	145,000	120,000	39,600	45,000
1980	61,100	102,000	163,100	120,000	54,100	60,000
1990	143,500	90,600	234,100	120,000	114,300	114,400
2000	295,700	84,200	379,900	120,000	259,900	261,000
2010	451,700	73,000	524,700	120,000	404,700	404,600
2020	543,300	56,600	599,900	120,000	480,000	480,000

a. Comprising subunits No. 137 through 147 and 153.

4. Coastal San Bernardino County. The data leading to demands for imported water in coastal San Bernardino County are presented in Table 54. This area is now more urbanized than coastal Riverside County, and continued urban pressures will cause the loss of agricultural production more rapidly than in the latter county. The rapid decline in the near future in acreage of irrigated lands is a factor in keeping the total water requirements from rising very rapidly under the impetus of population growth.

After 1990, there will be a sizable population residing in the mountains to the north of this area. The water required for this population will reduce the mountain water discharged to the valley floors. In lieu of more accurate information on this matter, the demand for imported water after 1990 was increased by 4,000 acre-feet per year in the valley lands to allow for decreased local water supplies.

TABLE 54

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN COASTAL SAN BERNARDINO COUNTY

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	47,000	111,900	158,900	134,200	25,600	8,000
1970	78,200	93,200	171,400	134,200	35,600	21,000
1980	119,400	72,600	192,000	134,200	56,000	25,500
1990	248,900	39,000	287,900	134,200	149,700	153,500
2000	430,100	21,000	451,100	134,200	312,600	316,800
2010	576,900	8,400	585,300	134,200	446,900	450,900
2020	651,900	400	652,300	134,200	513,800	518,500

5. Coastal San Diego and southwestern Riverside Counties. The values for this area are tabulated on Table 55. As will be noted, both urban and agricultural water requirements are projected as increasing by substantial quantities. The projected urban water use is based on the enormous population growth potential of all portions of the Southern California Coastal Plain and Coastal San Diego County Service Area, while the agricultural water use is due to the availability of vast areas presently not irrigated. These lands are capable of producing crops with high residual incomes, such as avocados, lemons, market tomatoes, strawberries, cucumbers and lettuce. The growing of market cut flowers, flower bulbs, and nursery stock were also projected as very favorable high income producing crops for the area.

TABLE 55

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN COASTAL SAN DIEGO COUNTY AND SOUTHWESTERN RIVERSIDE COUNTY[a]

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	163,500	94,400	257,900	124,300	133,600	136,000
1970	258,300	184,800	443,100	124,300	318,800	318,800
1980	363,100	235,900	599,000	124,300	474,700	474,700
1990	475,000	308,400	783,400	124,300	659,100	659,100
2000	598,100	352,300	950,400	124,300	826,100	826,100
2010	662,200	375,800	1,038,000	124,300	913,700	913,700
2020	720,800	396,500	1,117,300	124,300	993,000	993,100

a. Comprises subunits numbered 85 through 111, 117, 119, 120, 125, 128, 129, 130, and 133 through 136.

Ventura County Service Area

Data on water requirements, local water supplies, supplemental water requirements, and demand for imported water for the Ventura County Service Area are shown in Table 56. As these data illustrate, Ventura County, similar to the more southerly areas on the coastal plain, is expected to exhibit a continuing urbanization at the expense of agriculture. It has exhibited a spectacular increase of 200 per cent in manufacturing employment between 1949 and 1957, which has acted to attract people to the County in ever-increasing numbers. Mineral production is also a principal element in the County's economy, with the County's mineral production exceeding in value that of 25 states. The future base of the County's expansion, however, will be manufacturing, as mineral production is not expected to materially increase in the future.

This area possesses a fine equable climate conducive to the growing of truck crops, lemons, Valencia oranges, and avocados, which have unit residual incomes well above costs of imported water. These crops are estimated to comprise the majority of the projected crops throughout the 60-year period 1960 to 2020. During this period of time the large-scale farming operations in the county will be gradually converted into small, part-time orange, lemon, and avocado farming operations.

Ground water overdraft of serious proportions exists both in the Calleguas Municipal Water District and the Oxnard Plain area of the United Water Conservation District. Plans for additional local water supply development have been proposed to mitigate these problems. The State Water Rights Board in Decision D-884 approved in part Applications 13417, 13417A, and

13418. This has the effect of permitting the Calleguas Municipal Water District to proceed on a joint effort with the United Water Conservation District to develop the waters of Sespe Creek at the Topatopa dam site. This decision is presently being contested by the United Water Conservation District.

The Ventura River Municipal Water District in the westerly portion of Ventura County has contracted with the United States Bureau of Reclamation for the safe yield of 27,000 acre-feet of water from the Casitas Project, now nearing completion. This will supply the District's immediate and future needs for several decades.

The growth in economic demand for imported water in Ventura County and adjacent areas was based on the following assumptions:

(1) The joint development of Sespe Creek will be completed by 1970, and the safe yield therefrom will be allocated as per Decision D-884 of the State Water Rights Board.

(2) The upper ground water basins along the Santa Clara River will yield an additional 26,000 acre-feet annually by 1980 through increased extractions by overlying users.

(3) The Ventura River Municipal Water District will have sufficient local water supplies to sustain continued economic expansion therein until 1995, at which time it will commence using imported water.

Regardless of the final plan of development adopted for Sespe Creek and the allocation of water therefrom, the economic demand for imported water in the entire county, as presented in Table 56, would not be significantly changed.

TABLE 56

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN THE VENTURA COUNTY SERVICE AREA[a]

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	24,800	181,800	206,600	148,900	81,200	0
1970	42,600	186,000	228,600	178,900	67,800	10,000
1980	67,400	165,300	232,700	204,900	40,600	40,700
1990	111,000	142,600	253,600	204,900	54,400	54,600
2000	193,200	126,300	319,500	204,900	114,500	114,700
2010	275,100	97,300	372,400	204,900	167,400	167,900
2020	362,400	78,100	440,500	204,900	235,600	236,000

a. Comprises subunits numbered 42 through 44 and 46 through 48.

Santa Barbara Service Area

The Santa Barbara Service Area includes all of Santa Barbara County plus that portion of the Santa Maria Valley Water Conservation District located within San Luis Obispo County. The excellent prospects for increasing rates of population growth in this service area will act to limit agricultural expansion therein as some of the best agricultural lands in the area are also those lands with the highest potential for becoming urbanized during the study period.

The establishment of Vandenburg Air Force Base, formerly Camp Cooke, and the large federal expenditures for the development of this missile base has already caused an increase in economic activity in the Santa Ynez and Santa Maria Valleys, which will cause an early decline in extent of irrigated lands. These areas, which contain some of the best truck crop land in California, are projected to recover from the urban encroachment stimulated by Vandenberg Air Force Base by replacement plantings on less desirable agricultural lands on the peripheries of the Santa Maria and Lompoc Valleys.

Other areas in northern Santa Barbara County are handicapped by a growing season one-third less than that around Santa Maria or Lompoc. Thus, crops which can pay for imported water are limited in these areas. The demands for imported water projected for these areas, which includes the Los Alamos, La Zaca, and Santa Ynez subunits, are predicated upon the availability of imported water. Unlike the fertile valleys around Santa Maria and Lompoc, growth in irrigated agriculture creating demands for imported water in these areas would, in large part, not occur without the construction of an aqueduct through the area.

The south coastal area of Santa Barbara County, an area with excellent living conditions and a climate conducive to the production of high-value crops, is expected to develop in the future to an area of urban and suburban living with some small part-time farms. In the projections of irrigated agriculture it was assumed that the larger full-time farm will cease to exist. There are numerous small part-time lemon and avocado groves in the area at the present time and it was expected that this development will continue as increases in population put economic pressure on agriculture.

Crop acreages as visualized in the south coastal area of Santa Barbara County will increase from the present acreage of 14,500 acres to 25,600 acres on the basis of the small part-time farm. The principal crops projected are citrus, avocados, and truck crops. This follows the present crop pattern, but places more emphasis on lemons and avocados as these crops adapt themselves well to small part-time operation. It is anticipated that ability to pay for water will be no problem for these crops as residual income for payment of irrigation water and farming incentive is very high compared with assumed charges for water.

Local water supplies in the Santa Ynez Valley and in the south coastal portions of the county are presently adequate and should sustain growth therein through 1970. By that date, the south coastal portions of Santa Barbara County will require imported water as it is estimated that surface water yield will have been fully utilized, and local ground water basins are not capable of sustaining long-term heavy overdraft. In the Santa Maria Valley, it is estimated that substantial overdraft will exist by the early 1970s even with the yield from Twitchell Dam and Reservoir, recently completed, being available.

The growth in economic demand for imported water, summarized in Table 57, was based on the following assumptions:

(1) Increases in water requirements in the south coastal portions of the county after the year 1970 will be met by imported water.

(2) Imported water deliveries will begin in 1970 in the Santa Maria and Santa Ynez Valleys, and overdrafts therein will be gradually eliminated over the ensuing 15 years.

TABLE 57

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN THE SANTA BARBARA SERVICE AREA[a]

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	21,600	143,000	164,600	175,100	27,100	0
1970	30,900	144,600	175,500	180,500	29,000	15,300
1980	42,500	169,700	212,200	180,500	61,000	57,800
1990	62,000	182,700	244,700	180,500	93,600	92,800
2000	93,500	183,200	276,700	180,500	119,200	121,100
2010	131,600	187,600	319,100	180,500	153,800	153,900
2020	178,300	188,200	366,500	180,500	194,400	195,500

a. Comprises subunits numbered 22 through 39.

San Luis Obispo Service Area

The San Luis Obispo Service Area, for which data are summarized in Table 58, includes the Upper Salinas and coastal portions of San Luis Obispo County, but excludes the highly developed portion of the Santa Maria Valley Water Conservation District located within San Luis Obispo County, and the Cuyama Valley and Carrizo Plains. These two latter areas were studied and it was concluded that, due to their limited growing season and physical location with respect to the aqueduct, they did not have the ability to finance and pay for the facilities necessary to convey and distribute imported water.

For many years, economic demands for imported water in the service area will be relatively small. This condition is projected because (1) the area does not have a large urban population at this time and has not yet experienced population increases to the same extent of other portions of southern California; (2) the area has only a limited area of land that combines favorable topography with climatic conditions in a manner that high income producing crops may be grown thereon; and (3) the area possesses substantial amounts of presently unused local water resources that can feasibly be developed.

The economic demands for imported water in the study units were based on the following assumptions:

(1) Water storage projects will be developed in the coastal portion of San Luis Obispo County as needed, which, with full utilization of ground water supplies, will result in an increase of the safe yield of as much as 85,000 acre-feet per annum in this portion of the service area.

(2) Water storage projects will be developed in the Upper Salinas Valley as needed, which, with full utilization of ground water supplies, will result in an increase in safe yield of about 15,000 acre-feet per annum in this portion of the service area.

(3) Imported water will first be utilized in about 1971 in localized areas of the County, and all supplemental water requirements after the year 1990 will be met with imported water.

The economic demands for imported water resulting from application of the foregoing assumptions are set forth in Table 58. It can readily be seen that these demands would be substantially greater if the postulated local water development projects were not constructed. These local projects cannot be of assistance to all subunits, however, as conveyance costs would become prohibitive. Therefore, shortages of water will occur in some subunits at the same time that unused local supplies are available in other subunits. For this reason, there is a demand for imported water projected at the same time that there is an apparent surplus of local water supplies over water requirements.

The agricultural water requirements in Table 58 reflect a moderate amount of agricultural development that would occur only because of the construction of an aqueduct through the area. If an additional water supply were not made available in the service area, though, its economy would be seriously impaired after about 1990.

TABLE 58

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN THE SAN LUIS OBISPO SERVICE AREA[a]

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	8,000	45,700	53,700	87,800	3,000	0
1970	11,300	52,100	63,400	94,300	1,900	0
1980	17,000	71,900	88,900	128,200	5,800	5,000
1990	30,800	102,400	133,200	147,400	20,600	18,700
2000	58,500	104,300	162,800	174,100	28,400	27,700
2010	97,900	99,800	197,700	187,200	37,500	37,100
2020	134,800	89,800	224,600	189,200	54,800	54,800

a. Comprises subunits numbered 1 through 5, 7 through 19, and 21.

Antelope-Mojave Service Area

The development of the Antelope-Mojave Service Area has been to some extent retarded by the lack of an adequate water supply. A rather large agricultural economy has been built up in the Antelope Valley area over a period of years by overdraft on ground water, and urbanization of the area has been occurring in the last few years. Similar development has occurred in the Mojave River area. It is anticipated that agricultural lands in these areas will be reduced as a result of encroachment of urban growth and because of rising costs of pumping ground water. Based upon the assumptions employed herein that water costs to the farmer would be equal to the cost of water delivery, irrigated agricultural development would not be stimulated by importation of water as estimates of costs of northern California water delivered in the area exceed the probable ability of crops climatically adapted to the area to pay for such water.

The rate of growth of economic demand for imported water in this area was predicated on the following assumptions:

(1) Initial deliveries of imported water would occur in 1970 for the Antelope Valley area, including that portion of Kern County therein, and in 1980 for the Mojave River area.

(2) Overdraft on ground water supplies will continue as long as it is economically feasible to mine these supplies, with the amount of annual overdraft gradually decreasing to zero by year 2000.

The demands for imported water resulting from these assumptions are shown in Table 59, together with data on water requirements. These water requirements and resulting demands for imported water could be increased by the amount of water necessary to maintain a favorable salt balance in the area. There are many possibilities for procedures to eliminate urban wastes in closed inland basins such as the Antelope-Mojave Service Area, all of which have varying requirements for water. Without making detailed geologic and engineering investigations of these possibilities to determine the most economical procedure and the amount of water consumed in accomplishing the waste disposal, it is difficult to evaluate water requirements for waste disposal. Rough estimates indicate that this quantity would be in the order of 30,000 acre-feet per year at the year 2020, but, as this figure is so open to question, no provision was made at this time for water for waste disposal.

TABLE 59

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN THE ANTELOPE-MOJAVE SERVICE AREA

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	16,600	216,000	232,600	130,000	102,600	0
1970	37,300	208,600	245,900	130,000	115,800	15,000
1980	85,700	190,100	275,800	130,000	143,500	80,000
1990	142,500	161,000	303,500	130,000	172,400	142,000
2000	197,300	109,600	306,900	130,000	177,400	175,000
2010	238,000	86,700	324,700	130,000	195,000	195,000
2020	271,000	67,200	338,200	130,000	208,600	208,000

The high desert areas to the southeast of the Antelope-Mojave Service Area, and in particular that region between Morongo Valley and Twentynine Palms, have desirable living conditions, with less severe summer temperatures than those occurring in other regions in the desert. In the event that imported water is made available here, this area will have sizable population increases and resulting high requirements for imported water.

It is believed that the possibility of demands for imported water in the Morongo Valley-Twentynine Palms area is satisfactorily provided for in the combined projections for the desert areas of the Antelope-Mojave and Whitewater-Coachella Service Areas. The total urban growth projected for these desert service areas is consistent with the growth projected for the southern California area; however, it is impossible to accurately predict the particular area in which persons building in the desert will be residing.

Development here will be largely resort and retirement oriented, and the location of growth centers is dependent upon future happenings such as location of imported water facilities and activities of subdividers. Therefore, if one area actually receives more or fewer persons than estimated herein, it will probably occur at the expense or to the benefit of other desert areas. Thus, the urban water requirements in the entire desert area will essentially be as projected regardless of which locality in the desert receives the bulk of urban development.

Whitewater-Coachella Service Area

This area has a wide variety of land usage. Northwest of the Salton Sea, the land is devoted to production of dates, citrus and other subtropical crops, grapes, and truck crops. Proceeding up the Coachella Valley, the numerous desert resort communities, including Palm Springs and Desert Hot Springs, begin to occupy the land. Westward, in the vicinity of Banning, a small agricultural area is experiencing urban encroachment.

The suburban development occurring throughout the area from Banning through the desert communities is sustained by mining of ground water supplies. The intensively irrigated lands near the Salton Sea are dependent upon ground water extractions in excess of the safe yield thereof and on Colorado River water from the Coachella Branch of the All-American Canal. In portions of the urban areas, depths to ground water now exceed 400 feet and the local water supply situation is becoming critical.

Distribution costs of delivering northern California water to farmers' headgates, added to the assumed price of this water, would be about $80 per acre-foot. For this reason, no water deliveries were contemplated for agricultural use, even though it is possible that some deliveries may be made in the far distant future.

The assumptions followed in estimating the growth in demand for imported water are as follows:

(1) Imported northern California water would not be available in the area until 1982.

(2) Imported northern California water would only be used for urban purposes.

(3) Urban water requirements will be satisfied by purchases of imported water, use of local water supplies, and recapture, where possible, of urban water supplies not consumptively used.

(4) Ground water overdraft will continue throughout the study period, but will diminish with time.

The demands for northern California water based on the preceding assumptions, together with projections of urban water requirements, are shown in Table 60.

TABLE 60

URBAN WATER REQUIREMENTS AND GROWTH IN DEMAND FOR IMPORTED WATER IN THE WHITEWATER-COACHELLA SERVICE AREA

(In acre-feet per year)

Year	Net urban water requirements	Growth in demand for imported water
	Urban	
1960	12,100	0
1970	20,900	0
1980	34,200	0
1990	54,700	35,000
2000	81,900	55,000
2010	111,500	90,000
2020	134,600	100,000

Kern County Service Area

The Kern County Service Area comprises that portion of Kern County lying generally west of the North Kern Water Storage District and west of those organized districts receiving or having contractual rights to San Joaquin River water from the Friant-Kern Canal, but includes the Bakersfield metropolitan area. The excluded east side districts were omitted on the basis that their physical location with respect to the project aqueduct would make service uneconomical to these areas, considering the relatively small quantities of water that might be required late in the period of study.

The service area includes the Buena Vista Water Storage District, and the recently formed Semitropic, Wheeler Ridge-Maricopa, and Rosedale-Rio Bravo Water Storage Districts, and some 18 private and public water service agencies that distribute irrigation water in the delta area of the Kern River. In addition, the area contains extensive land areas for which organizational activity is presently not in evidence.

In the area, 962,000 irrigable acres are available for agricultural use plus 41,400 acres which are presently suited to agriculture but which it was estimated will have been converted to urban usage by year 2020.

The present annual water requirement for the Kern County Service Area was estimated to aggregate 940,000 acre-feet, with the needs of irrigated agriculture accounting for almost 900,000 acre-feet of this total. It was estimated that agricultural and urban water requirements will increase to 2,090,000 acre-feet and 365,000 acre-feet, respectively, by year 2020.

This growth in agricultural water requirement was projected even though Kern County does not occupy a monopolistic position with respect to any of the agricultural crops presently grown there. However, the county has been able to obtain advantages of crop yields and early maturity over other competing areas, largely as a result of a long growing season, mild winter climate, and excellent soils. These advantages presently apply principally to valley floor lands due to the physical and economic considerations involved in the development of available water supplies. However, the advent of project water service will permit exploitation of thermal conditions favorable to the production of citrus and deciduous fruits on presently dry lands in the western and southwestern portions of the county.

Cotton is a dominant crop under present conditions of development and is expected to retain this position in the future as more land is developed in irrigated agriculture. Potatoes are expected to retain their approximate present importance; while a substantial expansion in field crop acreages, associated on a rotation basis with cotton, is anticipated. Grape production is relatively unimportant in the area contemplated for project water service and, although expansion in grape acreage is expected, this crop will utilize only a minor quantity of project water.

Over 100,000 acres of high quality irrigable land, still in its native state, lying generally above the proposed route of the Feather River Project Aqueduct, is considered by authorities in the field of pomology to be highly suitable to the production of deciduous and citrus fruits.

A substantial increase in the acreage devoted to the production of truck crops is also anticipated. As the market expands due to an increasing California population, and as the truck crop areas south of the Tehachapis are encroached upon by urban development, additional impetus will be given to the production of Kern County of truck crops for the Los Angeles markets.

This agricultural growth will serve to strengthen Kern County's prime contribution to the economy of both California and the Nation in agricultural and mineral production. Its value of mineral production in 1956 was greater than that of 33 states, while the county's farm products were exceeded in value on a national basis by those of only two counties. In terms of urban growth, Kern County has also been forging ahead. From 1949 to 1957, manufacturing employment in the county increased 120 per cent, while the county's population increased about 23 per cent.

The county's future, however, is dependent upon the availability of additional supplies of water. In the Semitropic and Wheeler Ridge-Maricopa Water Storage Districts, which account for about a quarter of the county's agricultural production, mining of ground water has resulted in water levels continually falling at rates of up to 25 feet a year. The magnitude of the current overdraft in the area is estimated to be 540,000 acre-feet annually.

The rate of growth of economic demand for imported water in this area was based on the following assumptions:

(1) Initial deliveries of imported water will occur in 1965.

(2) The Arvin-Edison Water Storage District will obtain all of its supplemental water requirements through its contract for water from the Friant-Kern Canal either directly or by exchange for Kern River water. This will eliminate the pumping trough in the District and in time eliminate the subsurface outflow of 120,000 acre-feet from the Kern County Service Area into this District. Thus, it is estimated that by 1970, the Kern County Service Area's local water supplies will be increased by 120,000 acre-feet.

(3) A further exchange of 160,000 acre-feet of Friant-Kern Canal water for project water will be effected within the service area, permitting a like quantity of project water to be served from the lowest reach of the San Joaquin Valley-Southern California Aqueduct.

(4) Mining of ground water will continue in the service area as long as it is economically advantageous.

The demands for imported water and related data for the Kern County Service Area are tabulated on Table 61. Kern County is commonly thought of as having a demand only for agricultural water. However, Table 61 indicates that the county may expect substantial increases in urban water requirements centered principally in the Bakersfield metropolitan area. As there are indications that the water supply available to the city of Bakersfield may soon be inadequate, and since these urban requirements must be satisfied by imported water, a substantial urban demand will be created for northern California water in the southern San Joaquin Valley.

TABLE 61

WATER REQUIREMENTS, LOCAL WATER SUPPLIES, SUPPLEMENTAL WATER REQUIREMENTS, AND GROWTH IN DEMAND FOR IMPORTED WATER IN THE KERN COUNTY SERVICE AREA

(In acre-feet per year)

Year	Net water requirements			Local water supplies	Supplemental water requirements	Growth in demand for imported water
	Urban	Agricultural	Total			
1960	50,000	896,000	946,000	400,000	546,000	0
1970	79,000	1,174,000	1,253,000	520,000	733,000	146,000
1980	103,000	1,644,000	1,747,000	520,000	1,227,000	823,000
1990	139,000	2,072,000	2,211,000	520,000	1,691,000	1,409,000
2000	198,000	2,220,000	2,418,000	520,000	1,898,000	1,606,000
2010	280,000	2,148,000	2,428,000	520,000	1,908,000	1,700,000
2020	365,000	2,092,000	2,457,000	520,000	1,937,000	1,785,000

Qualitative Effects of Variations in Basic Assumptions on Demands for Imported Water

Throughout the foregoing study, it has been the objective to make all investigations under those assumptions of future conditions considered most probable of attainment, which were determined with full consideration of the course of past events and a careful analysis of the pattern expected in the future. Estimates of future water requirements resulting from studies based upon those assumptions of future conditions adopted here will, of course, be different from those based upon another set of assumptions, and an attempt has been made in the following paragraphs to evaluate the effect on water demands of variations in the basic assumptions.

Climate

Since the entire investigational area experiences a climate of a cyclic nature, the use of imported water will vary during wet and dry portions of the cycle because of differences in the availability of local water supplies. As the demands developed herein reflect long-term mean conditions of climate, they are subject to annual variations under actual climatic conditions. These variations result from changes in water use patterns as well as changes in water supply conditions.

As previously mentioned, there is only a minor effect in urban water usage during periods of above normal rainfall, and this occurs only when the precipitation is above normal during the late spring and early fall months. Agricultural water demands are likewise influenced only slightly by variations in annual precipitation, with a maximum probable change in water requirements for most crops being in the range of 10 to 15 per cent of annual delivery requirements.

Local water supplies in southern California are developed through extractions from ground water basins, reservoirs regulating surface runoffs so as to achieve a uniform annual yield, and direct diversions of surface runoff. Of these three sources of local water, annual diversions of surface runoff is most affected by varying climatic conditions. However, this is not a major source of water supply in the southern California area, except from the Kern River in Kern County. In the area served by surface diversions from the Kern River, fluctuations in annual demands for imported water could be experienced. The presence of major flood control storage in Isabella Reservoir, however, tends to minimize the magnitude and frequency of such fluctuations. As project deliveries to the area receiving water diverted from the Kern River comprise a relatively small portion of the supplemental requirements of the entire Kern County Service Area, it is believed that the effect of varying climatic conditions on total project water deliveries therein would be insignificant.

Water supplies in storage in most southern California ground water basins would not be influenced by seasonal variations in climatic conditions. However, those areas that purchase imported water for recharging ground water basins may curtail activities during wet periods. The Department of Water Resources has conducted studies on the operation of spreading grounds throughout the South Coastal Area, and has found that, for the representative period 1936-37 to 1951-52, most spreading grounds were available an average of 11 months of each year for ground water recharge with imported waters. The time available for spreading imported water would be not less than 9 months a year even under excessively above-normal-precipitation conditions. It was concluded that variations in precipitation would not substantially limit the imported water requirements for artificial recharge projects.

Several entities in San Diego County rely upon surface reservoirs for a major portion of their local water supplies, and it has been assumed that these reservoirs would be operated on a safe yield basis. As long as there is excess aqueduct capacity into San Diego County, it is likely that some of the local reservoirs will be operated on a basis of extractions therefrom at rates in excess of safe yields during periods of relatively high local surface runoff. However, as the cessation of taking of imported water in prior years must be followed in subsequent years by the taking of imported water in amounts equal to the safe yield lost through excessive storage withdrawals as well as the supplemental requirements, the net effect of this practice on total project water deliveries is estimated to be minor.

It is unlikely that the cumulative effect of variations in demands for imported water caused by departures from normal precipitation in southern California in any one year will be of major proportions and, if the basis of the projection of water demands is correct, the long-term trend will prevail.

Aqueduct Location

The demand for imported water is based on the application of a basic assumption that each area will repay the full allocated cost which results from the system that would serve that area at the least cost, with water being made available at the earliest possible date of construction. In the major portion of the investigational area, located south of the Transverse Ranges, demands for imported water would not be materially influenced by the location of the aqueduct route in either one or the other principal locations which were investigated. However, there would be an effect upon economic demand for imported water in the Santa Barbara, San Luis Obispo, and Kern County Service Areas, depending upon final aqueduct location and price of delivered water.

This effect would result from the higher unit cost of water delivered from a stub line to serve the areas as compared to the cost of delivery from a main aqueduct traversing these areas. The resulting higher cost of water, if sale price reflects cost, would act to reduce agricultural water deliveries in San Luis Obispo, Santa Barbara, and Kern Counties as explained in the discussion of the effect of price on demand for water. This loss of service would act again to increase the unit cost of water deliveries to the coastal counties from a stub line.

In the portions of the coastal counties that do not have access to either surplus surface water or ground water basins of sufficient capacity to sustain long-term overdrafts, the projected increases in agricultural and urban water requirements were based on the assumed construction of an aqueduct. If, in fact, no aqueduct were built, the projected water demands in these counties would be reduced correspondingly.

Price of Imported Water

Studies were made of the effects of varying prices for imported water on the demands for such water. Within the range of prices investigated, there did not appear to be any appreciable effect of price on urban and industrial demands for imported water. Agricultural usage of water was found to be influenced by price thereof in the central coastal counties, San Diego and southwestern Riverside Counties, and in Kern County. In the balance of the South Coastal Area, the rapid encroachment of urban entities on agricultural lands diminishes the effect of water price on irrigated acreages.

The effect of price on irrigated acreage and resultant demands for imported water are shown by a series of curves on Figures 21, 22, and 23. As indicated by these charts, a varying economic growth of irrigated acreage and demand for imported water would result for varying prices of imported water. For example, on Figure 21, the demand for imported water in San Luis Obispo and Santa Barbara Counties, at the highest price for water, of about $46 per acre-foot at the aqueduct, would be 37,000 acre-feet in 1975. At the lowest price indicated for imported water of about $12 per acre-foot at the aqueduct, the demand for imported water would be 55,000 acre-feet.

Similar effects of price variations on economic water demands are noted on the other Figures for other areas, with the curves for the Kern County Service Area indicating substantial differences in demands at high and low water prices.

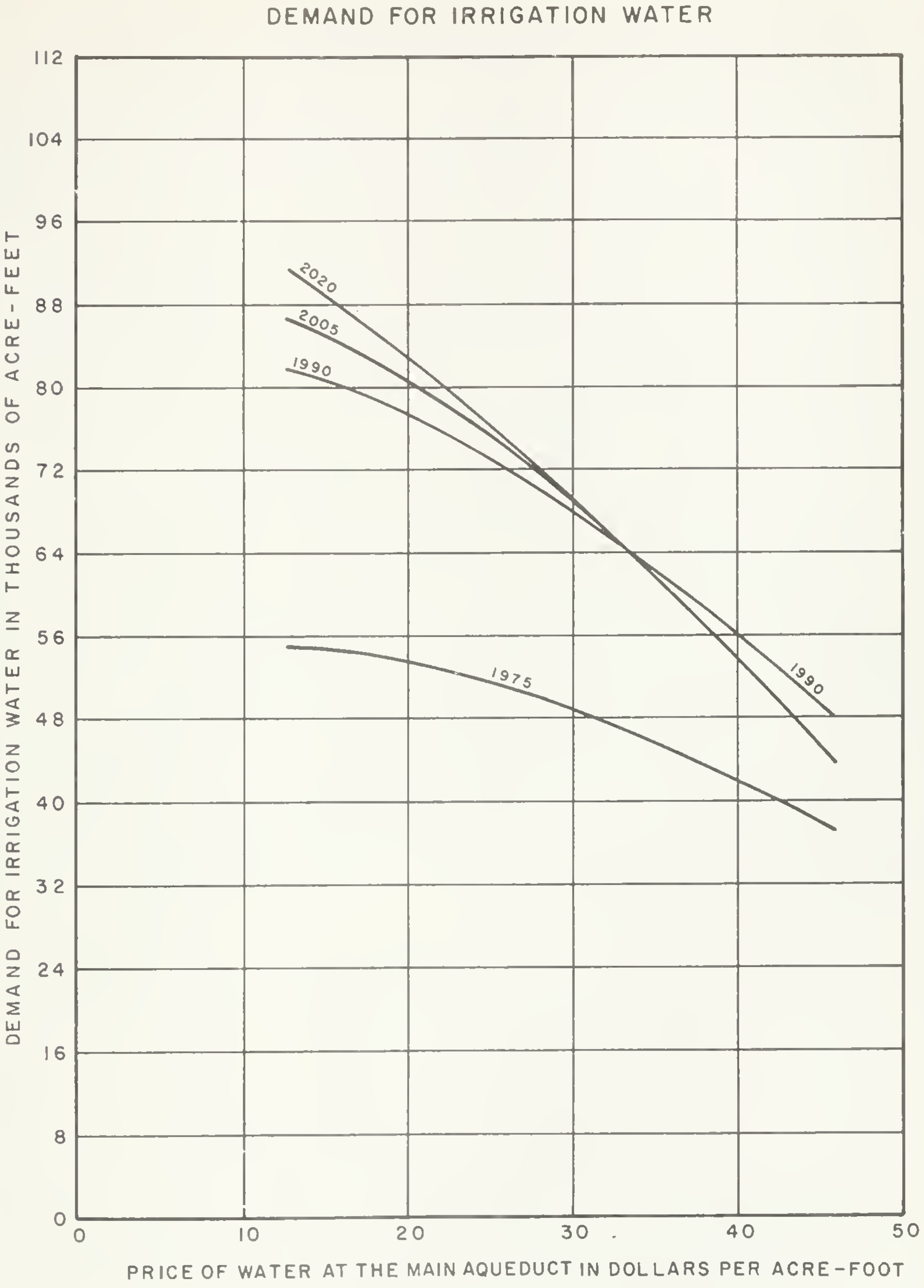
Rate Design

The projections of economic demand for imported water discussed herein are based on a single charge per acre-foot of water, uniform throughout the repayment period, which includes capital, interest, operation, maintenance, and all other expenses. The application of other possible rate schedules, such as a two-part rate, would be significant on the shape of the demand curve during early years of the project. The over-all effect on project water deliveries under a two-part rate would require a reanalysis of the projected urban and agricultural growth in demand for imported water in all subunits.

Projected Population

By analyzing the results of the study of in-migration to California it was concluded that the median projection of population is much more likely of attainment than either the high or low projection. However, many recent projections of southern California's population during the near term future have been close to the high level of projection developed in this study. If the population reaches levels indicated by the high projection by 1990, the nine southern California counties would contain about 1,700,000 persons more than that resulting from the median projection. Using 180 gallons per capita per day as the average consumptive use of urban water, this increase in population would result in an increase in demand for imported water of about 340,000 acre-feet per year for the year 1990. Conversely, if southern California's population developed along the lines of the low projection, there would be about 1,300,000 persons less by 1990 than the number estimated under the median projection, which would result in a decrease of about 260,000 acre-feet per year in demand for imported water in the year 1990.

FIGURE 21

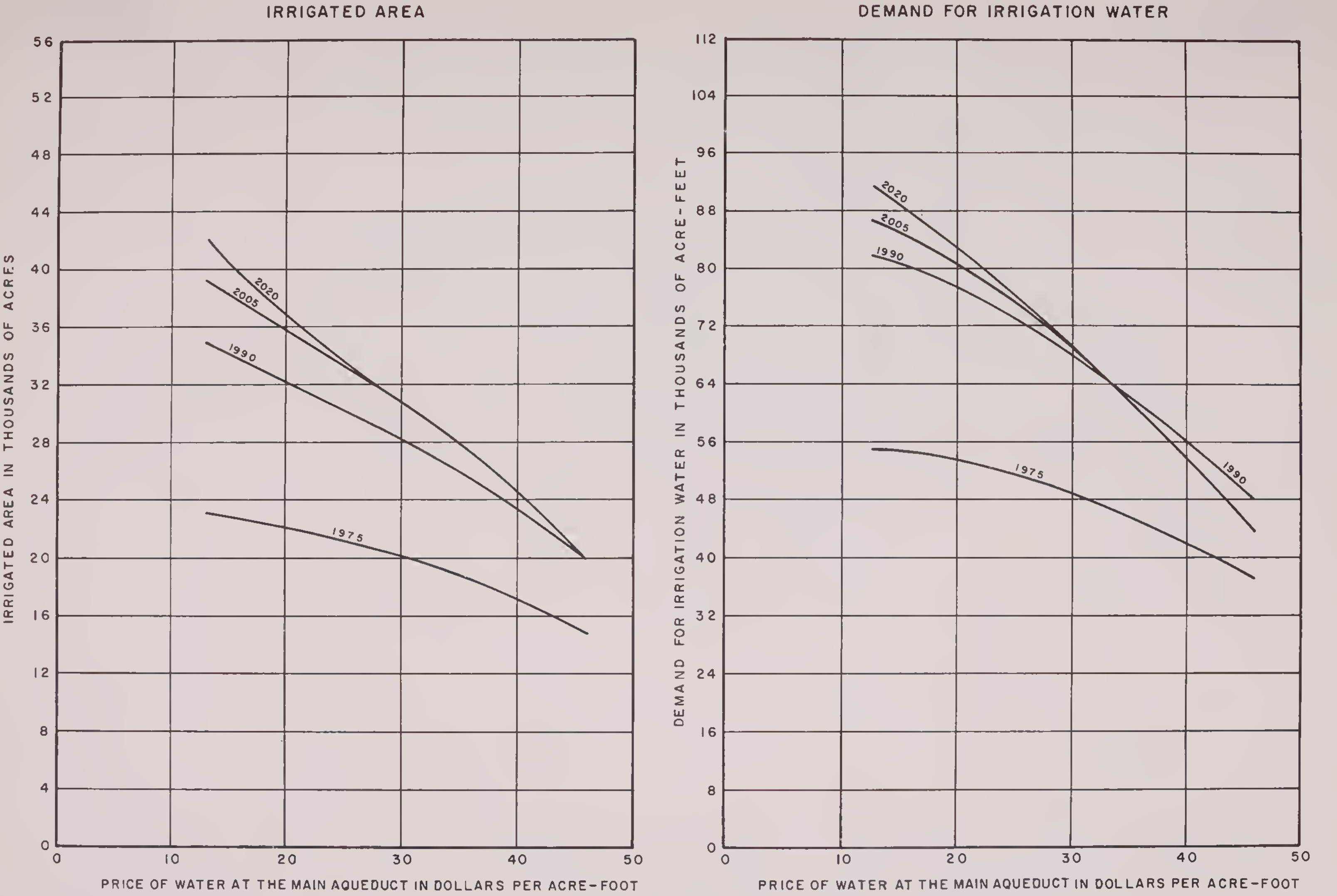


DEMAND FOR IRRIGATION WATER

PS BETWEEN

PRICE OF SURPLUS NORTHERN CALIFORNIA WATER

ANTA BARBARA COUNTIES



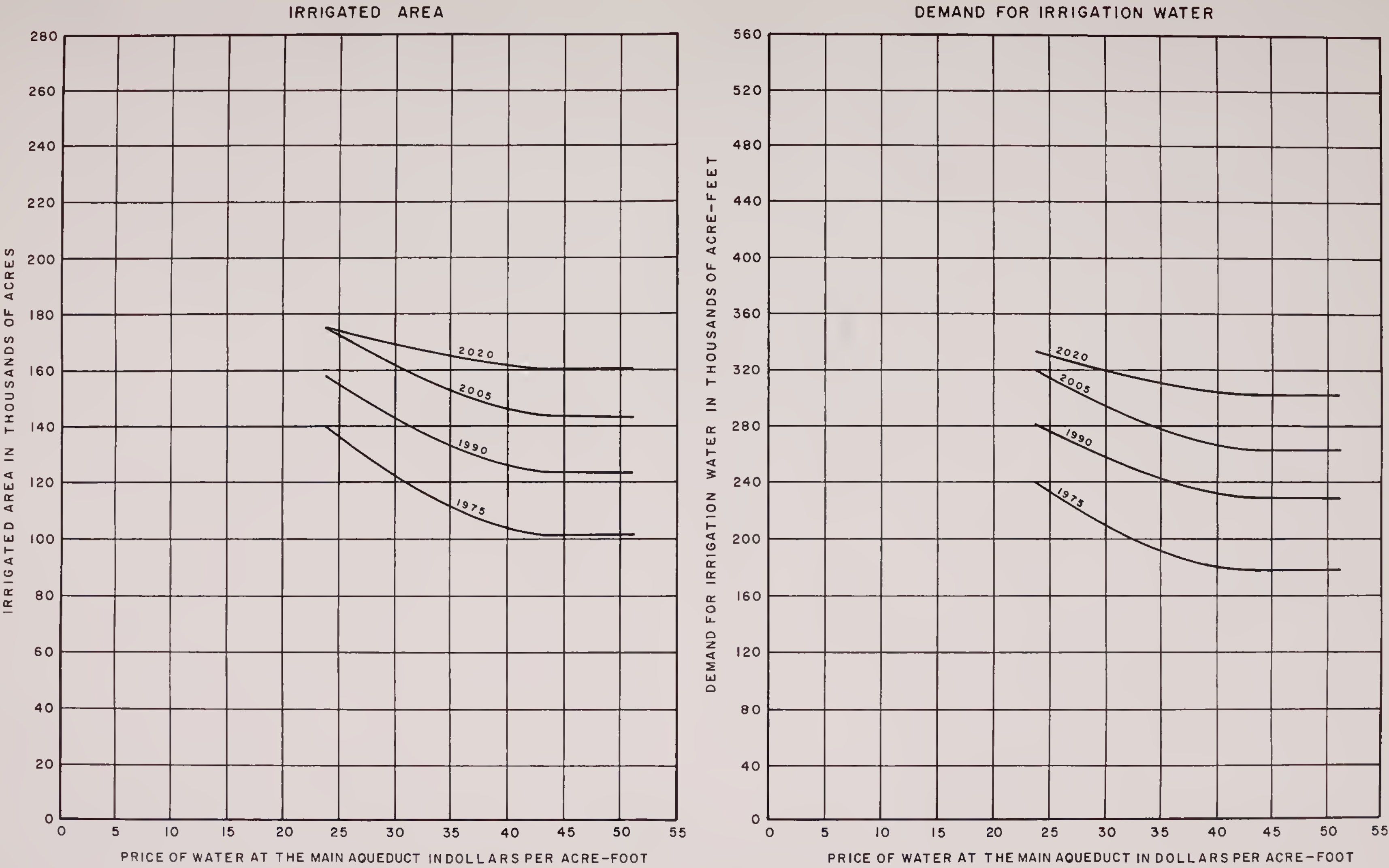
RELATIONSHIPS BETWEEN

IRRIGATED AREA, DEMAND FOR IRRIGATION WATER, AND PRICE OF SURPLUS NORTHERN CALIFORNIA WATER

IN SAN LUIS OBISPO AND SANTA BARBARA COUNTIES

DEPARTMENT OF WATER RESOURCES 1959

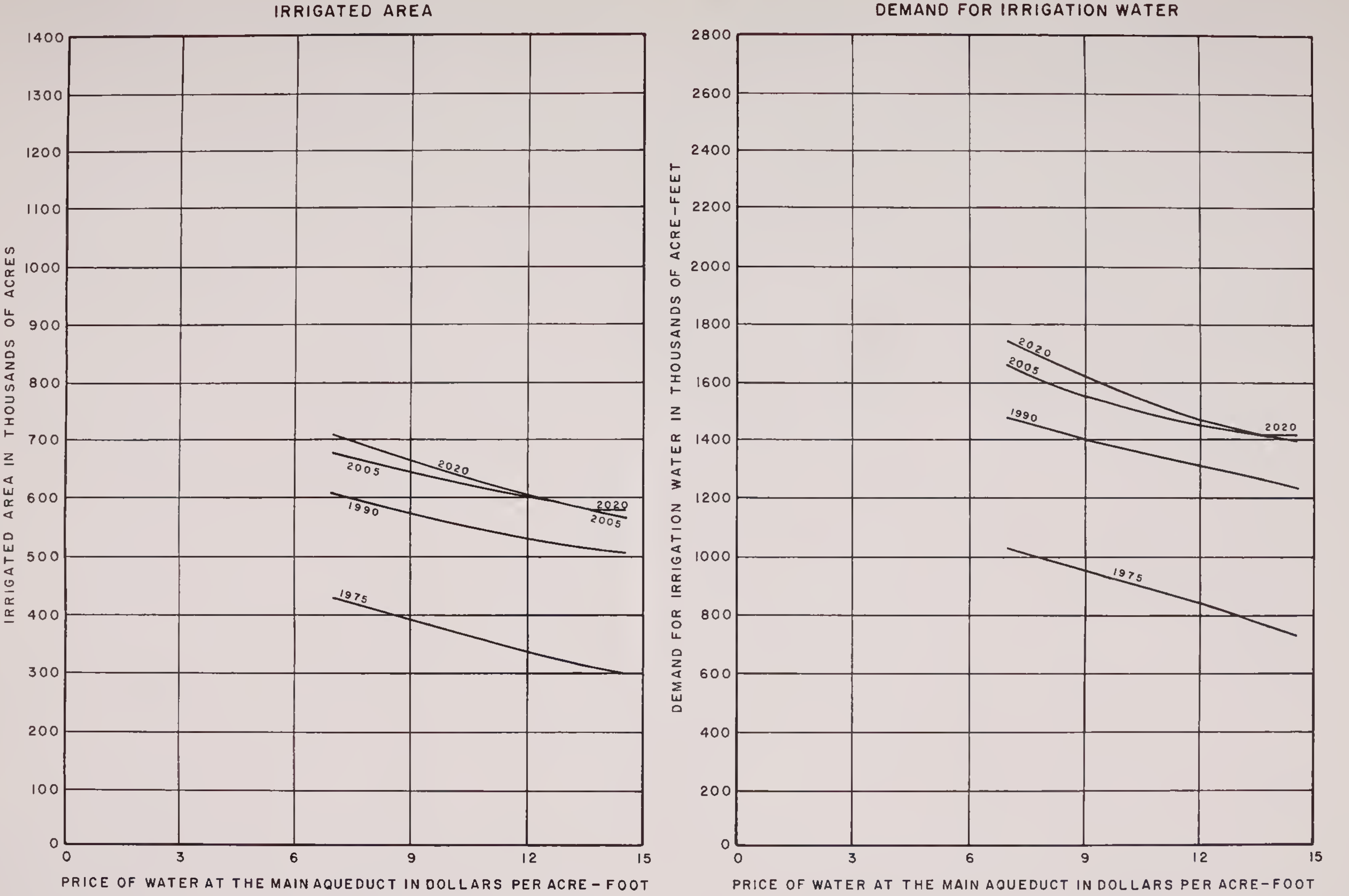
NOTE:
IN THE METROPOLITAN WATER DISTRICT SERVICE AREA, VALUES REFLECT USE OF BOTH COLORADO RIVER WATER AND NORTHERN CALIFORNIA WATER.



RELATIONSHIPS BETWEEN

IRRIGATED AREA, DEMAND FOR IRRIGATION WATER, AND PRICE OF IMPORTED WATER

IN VENTURA, COASTAL RIVERSIDE AND SAN DIEGO COUNTIES



RELATIONSHIPS BETWEEN
IRRIGATED AREA, DEMAND FOR IRRIGATION WATER, AND PRICE OF SURPLUS NORTHERN CALIFORNIA WATER
IN KERN COUNTY (SAN JOAQUIN VALLEY)

In addition to the specific conditions which have been considered for the low projections, smog in the South Coastal Area, depressed national economic conditions, and changes in the United States immigration policy have also been studied to determine their probable effect on the median projection of California's rate of growth.

Depressed Economic Conditions. Assumptions of depressed economic conditions were inherent in the low population projection, but even under these adverse conditions California in-migration will continue to be sizable. For example, in the last period of severely depressed economic conditions, from 1930 to 1940, net in-migration to California averaged about 100,000 persons per year. The median forecast utilized California in-migration rates that varied over time from 300,000 to 100,000 persons. Thus, depressed economic conditions nationally will probably result in less California in-migration and the "low" projection of California's growth will probably be achieved.

Smog. California's excellent climate, good recreational areas, and the other attractive features of its physical environment far overshadow the unattractive aspect of smog. During the past 13 years that smog has been at irritating levels, in-migration into Los Angeles, Orange, Riverside, and San Bernardino Counties has been at record-breaking levels, with no present indication of diminution of the rate of in-migration. During the past ten years, the population in these counties has increased 50 per cent while the air pollution level has remained fairly constant. There are indications that future control procedures will be able to limit pollution to present levels even under a three-fold increase in population. Thus, this factor is not seen to be a deterrent to population growth.

United States Immigration. The level of United States immigration assumed for the population projections is minor compared to the native rate of natural increase. Thus, the effect of eliminating immigration would be to decrease the national median projected population by only one per cent by year 2020. The direct effect of halting United States immigration on net in-migration to California would likewise be negligible.

Construction of Ocean Outfall Sewers

In interviewing responsible persons in the Upper Santa Ana Valley, it was found that many believed that construction of an ocean outfall sewer may occur prior to 1970. It was assumed in the foregoing studies that such a sewer would not be constructed until 1985 with the complete connection of the basin thereto not occurring until 2010. If these assumed dates were advanced 15 years to initial construction of a sewer in 1970, annual supplemental water requirements in the Upper Santa Ana Valley would be an average of 57,000 acre-feet more than projected for the period 1970 to 2000. By not constructing such a sewer prior to the year 2020, annual supplemental water requirements would be an average of 412,000 acre-feet less than projected for the period 1990 to 2020. However, the effect of no outfall sewer from the Upper Santa Ana Valley is impossible to determine without also considering the problems of salts accumulation in the local ground water basins. It is definitely probable, as shown by Appendix B of Bulletin No. 78, that the ground waters of both the Upper Santa Ana Valley and Orange County would become useless unless an ocean outfall sewer were constructed. In that event, the return flows of urban applied water in those areas would not be susceptible of re-use. Therefore, it appears highly probable that an ocean outfall sewer will be constructed within the next 25 years.

Metropolitan Water District Membership

In estimating the rate of growth in demand for imported water, it was assumed that some of the outlying areas would not join The Metropolitan Water District of Southern California to obtain supplemental water but would take northern California water when it becomes available, which was estimated in these areas to be about 1982. If such areas join the Metropolitan Water District at an earlier date, the supplemental water requirements of these areas would be met at least partially by purchases of imported Colorado River water. These supplemental requirements increase from 16,000 acre-feet in 1960 to about 31,000 acre-feet in 1980, and similar increases in imported water demands would also occur. If these outlying areas join the District, the date when the supply of Colorado River water is fully utilized would be advanced from present estimates.

Ground Water Basin Overdraft

The Central Basin in Los Angeles County is included in a proposed ground water replenishment district now under study. If this replenishment district is formed and meets the overdraft on the Central Basin by artificially recharging the basin with imported water, net overdraft therefrom will be halted. The city of Long Beach instituted a suit that may lead to adjudication of the Upper San Gabriel Valley Basin and the Central Basin, which would probably result in cessation of overdraft in those basins. In addition to these indications of future events, there is widespread public recognition, which has been spearheaded by responsible local officials and community leaders, of the seriousness of long-term continued overdraft of major proportions in these basins. The realization of these possibilities for the near future elimination of overdraft in the Central Basin and the Upper San Gabriel Basin would result in an increased demand for imported water in these areas of 240,000 acre-feet per year in 1970. This would advance the date of full utilization of the Colorado River supply to 1966.

Conversely, an assumption that overdrafts of Coastal Plain Basins will continue indefinitely is not practicable, as underlying ground water basins are of finite capacity. The continued advance of sea water intrusion caused by continued overdrafts which intensify landward ground water elevation gradients prevents the adoption of an assumption of continuous overdraft, particularly that of the magnitude of recent years.

In portions of the Kern County Service Area, ground water overdraft could continue throughout the study period at present levels of extraction. Pumping costs, however, would exceed the estimated cost of imported water during the latter years of the study period. As one of the bases for the projection of the growth in demand for imported water in these areas involved determination of the most economic relationship between mining ground water reserves and purchasing imported water, it is not believed likely that local entities would voluntarily continue the practice of overdraft pumping at economically disadvantageous rates.

Water Quality Considerations

One of the basic planning assumptions of this investigation was that water adequate in quality as well as in quantity would be available to all areas. However, the planned distribution of water from Aqueduct

System "A" would result in delaying the introduction of northern California water into the Upper Santa Ana Valley and a connection with the southwestern Riverside-San Diego Aqueduct system until about 1990, forcing these areas to rely upon Colorado River water in the interim. As previously mentioned, the Stanford Research Institute's study of the effects of the differences in the quality of Colorado River and northern California water, reported as Appendix B of Bulletin No. 78, was limited in scope to the Upper Santa Ana Basin, southwestern Riverside County, and coastal San Diego County. This report indicates that during the time interval from 1962 to 1990, the additional water required in those areas due to lack of availability of northern California water would be about 2.6 million acre-feet. This is an estimate of the quantity required for agricultural leaching purposes and for industrial water, and includes the quantities required to replace the loss of ground water supplies due to degradation of local basins. This quantity of water would have to be provided to these areas over and above the water requirements summarized herein if Aqueduct System "A" were to be constructed.

Unit Water Use

The rate of increase in unit urban water use was projected on a conservative basis. By adhering more closely to the historical rates of increase, projected unit use would be greater for the various areas, which would result in increased water requirements. However, lower rates of increase in unit use could be assumed, with resulting decreases in water requirements.

Development of Local Water Supplies

If it were assumed that no additional water development projects were built in San Luis Obispo County, there would be an increase of 101,000 acre-feet in the annual requirements for imported water by 2020. In Ventura County the additional projects anticipated to be constructed would yield 56,000 acre-feet per year which would have to be met by importation if the projects were not developed. However, in both of these counties there are historical precedents which indicate that these local projects will indeed be constructed, provided that there is no financial incentive to use imported water in place of locally developed waters.

ATTACHMENT NO. 1

ORGANIZATIONS AND PERSONS MATERIALLY CONTRIBUTING TO THE INVESTIGATIONS

Organizations and Persons Materially Contributing to the Investigations

The Department of Water Resources acknowledges the information, advice, and opinions which were obtained during the course of the investigation from hundreds of persons and organizations located principally in the southern California area. On the governmental level, organizations which were solicited for assistance and made valuable contributions to various phases of the investigation included the following in the Counties of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, San Diego, Riverside, San Bernardino and Kern:

1. County Planning Departments
2. County Assessors and Auditors
3. Flood Control and Water Conservation Districts
4. County Water Districts
5. Public Works Departments
6. Agricultural Commissioners
7. Agricultural Extension Services
8. United States Department of Agriculture, Agricultural Stabilization and Conservation Offices
9. Irrigation Districts
10. Municipal Water Districts
11. Public Utility Districts
12. Water Conservation Districts
13. Water Storage Districts
14. Special Districts
    a. Santa Barbara County Water Agency
    b. Metropolitan Water District of Southern California
    c. San Diego County Water Authority
    d. Orange County Water District
15. Cities
    a. Water Departments
    b. Planning Departments
    c. Public Works Departments
16. United States Government Agencies
    a. Army Corps of Engineers
    b. Military Bases
    c. Forest Service
    d. Bureau of Reclamation
    e. Department of Commerce Field Office
    f. Indian Affairs

Assistance on a state-wide or nationwide level was obtained from these agencies:

1. University of California Agricultural Extension Service
2. State of California Agencies
    a. Department of Employment
    b. Department of Industrial Relations
    c. Department of Natural Resources
    d. Board of Equalization
    e. Public Utilities Commission
    f. Department of Finance
    g. Department of Public Works - Division of Highways
3. United States Government Agencies
    a. Department of Commerce
        Bureau of the Census
        Office of Area Development
        Office of Business Economics
    b. Army Corps of Engineers; various regional offices
    c. Bureau of Reclamation

In addition to this valuable assistance from governmental agencies, the Department received the cooperation of private organizations, as briefly summarized following:

1. Agrucultural packing and marketing organizations
2. Mutual and public utility water companies
3. Electric, gas, and telephone public utilities
4. Banking and insurance institutions
5. Research organizations
6. Ranch operating and holding companies
7. Manufacturing companies
8. Trade organizations and associations
9. Consulting engineers

A field survey was made of actual farm operations throughout the southern California area, which involved the obtaining of comprehensive information on all aspects of crop production and costs from operators records. About one hundred and fifty persons owning or operating farms were contacted to obtain this detailed information. Space does not permit the listing of these persons, but their assistance and cooperation is gratefully acknowledged.

There were many individuals and organizations who assisted the Department's investigation through private study or through making repeated contributions thereto. These individuals and organizations, listed below, are accorded especial thanks:

Mr. Paul Beermann, Director, San Diego Water Department
Mr. Leland Bennett, General Manager and Chief Engineer, Ventura River Municipal Water District
Mr. Curtis Berryman, County Director, Agricultural Extension Service, San Luis Obispo County
Mr. George D. Bjurman, Vice President, Occidental Life Insurance Company of California
Mr. Doyle F. Boen, General Manager and Chief Engineer, Eastern Municipal Water District
Mr. Robert H. Born, County Hydraulic Engineer, San Luis Obispo County Flood Control and Water Conservation District
The Honorable C. W. Bradbury, Supervisor, District I, County of Santa Barbara
Mr. Roy A. Britt, President, Citizens National Trust and Savings Bank of Los Angeles
Mr. Howard G. Brunsman, Chief, Population Division, Bureau of the Census, United States Department of Commerce
Mr. Gerald Busch, Lockheed Aircraft Corporation
Mr. J. Edward Day, Vice President in Charge of Western Operations, Prudential Insurance Company of America
Mr. Calvin C. Delphey, Agricultural Extension Service, Ventura
Mr. C. C. DePledge, Senior Vice President, California Bank
Mr. Wilford Donley, Economics Department, Standard Oil Company of California
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Mr. James Engles, Engineer, U. S. Bureau of Reclamation, Fresno, California
Mr. Bernard Etcheverry, Kaiser Steel Company
Mr. Carl Frisen, Senior Research Technician, Budget Division, Department of Finance
Mr. Ray C. Geiberger, County Director, Agricultural Extension Service, Santa Barbara County
Mr. Maurice Gershenson, Chief, Division of Labor Statistics and Research, California Department of Industrial Relations
Mr. W. J. Herrman, Vice President, Southern California Gas Company
Mr. Lauder Hodges, Vice President, Citizens National Bank of Los Angeles
Mr. J. O. Hoyt, County Director, Agricultural Extension Service, Bakersfield County
Mr. C. C. Jamison, Vice President and Manager, Research Department, Security-First National Bank
Mr. W. F. Kirk, Manager, Economics Department, General Petroleum Corporation

Mr. Oscar T. Lawler, Senior Vice President, Security First National Bank
Mr. N. L. McFarlane, County Director, Agricultural Extension Service, Riverside County
Mr. Robert L. Minckler, President, General Petroleum Corporation
Mr. R. C. Moore, International Business Machines Corporation Western Regional Office
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Mr. John Pehrson, Farm Advisor, Orange County
Mr. A. F. Poulter, Division Manager, California Water and Telephone Company
Colonel W. F. Powers, District Engineer, U. S. Army Engineer District, Philadelphia
Mr. William Price, Chief Engineer and General Manager, United Water Conservation District
Mr. D. C. Purnell, Farm Advisor
Mr. William E. Rand, Vice President, Newhall Land and Farming Company
Mr. George S. Roche, Chief, Research and Statistics Section, Department of Employment
Mr. Harry S. Schwartz, Senior Economist, Federal Reserve Bank of San Francisco
Mr. Kenneth Smoyer, County Director, Agricultural Extension Service, Los Angeles County
Mr. Robert G. Spiegelman, Southern California Research Council
Mr. Jesse W. Tapp, Chairman of the Board, Bank of America
Air Force Ballistic Missile Division, United States Air Force

ATTACHMENT NO. 2

STATEMENTS OF CONSULTANTS FOR REVIEW OF STUDIES OF FUTURE URBAN AND AGRICULTURAL GROWTH

STATEMENT BY VAN BEUREN STANBERY, DEPARTMENT OF WATER RESOURCES CONSULTANT ON POPULATION AND ECONOMIC STUDIES, BEFORE HEARING OF CALIFORNIA WATER COMMISSION, LOS ANGELES, CALIFORNIA, DECEMBER 5, 1958

Mr. Chairman, Members of the State Water Commission, Ladies and Gentlemen:

California has long been a population magnet. Its attraction of people elsewhere is increasing. Since 1950, the net inflow to California has averaged about 300,000 a year. No other state is receiving so many so fast. Naturally, California officials are concerned about future water supplies for the rapidly growing population.

Moreover, the recent population upswing in the nation and California has enlarged the long-term outlook. The U. S. Bureau of the Census now estimates that if current fertility rates continue, the United States would have 260 million people by 1980. Projected ahead on the same basis, they would exceed 500 million by the year 2020. These figures are far above any previous authoritative projections. Furthermore, low projections of the national population released by the Census Bureau November 10, 1958, are higher than its former low projections.

California's long-term growth prospects likewise have been amplified. The recent upsurge of births throughout the Nation and State should induce recurring upsurges as the children of today come into the childbearing ages followed by their children in turn. In addition, the larger national population will expand the pool of potential migrants to California. The estimating of future water demands in southern California obviously required long-term population projections geared to the new outlook.

Accordingly, the State Department of Water Resources has developed a comprehensive series of new population projections. High, low and median projections of the populations of the United States, California, and the eight major regions of the State were developed for each census year 1960 to 2020. A similar series of population projections then was developed for each of the nine southern California counties. This was followed by detailed median projections of the populations of the several water service areas within these counties.

The statistical work was carried out by logical, systematic procedures. The latest available population data were obtained from authoritative sources. The projections were computed mainly by the natural increase and net migration method from detailed studies of the probable range of future fertility and mortality rates and net migration for the particular area. Hence, they have a broader foundation than projections based solely on mathematical extrapolations of population growth curves or the relative rates of past population growth in the Nation, State, and smaller areas.

The assumptions of future net migration were derived from analyses of local demographic, economic and physical factors influencing future population growth in the area. Included, also, were the expected effects of the projected growth of the larger areas on that of the successive smaller areas within them. Thus, viewed as a whole, the population projections form a hierarchy of mutually consistent figures.

As would be expected, the median projections are generally higher for the years 1980 to 2020 than those heretofore published by official agencies.

In California, as in other areas receiving continuous net in-migration, population growth and economic expansion are interdependent. Occasionally, population has surged ahead of employment temporarily. But over the long run, California's population growth invariably has been accompanied by a concomitant increase of economic activity and employment. Economic studies and projections of employment in the United States, California, and the nine southern California counties to 1980 by the Department of Water Resources show that this interrelation of population and economic growth can be expected to continue to that date, at least.

Another purpose of the employment projections was to determine the general pattern of economic development in the State and the southern counties to 1980 commensurate with their median population projections. For example, the projected increases of employment in the urban activities of manufacturing, distribution and services and in the nonurban agriculture and mining were helpful in projecting the expected expansion of urban populations and urban areas in the southern counties to 1980.

A hierarchy of mutually consistent median projections of average civilian employment in the years 1960, 1970 and 1980, related to the corresponding median population projections, was developed. Projections of Gross National Product and of employment in the principal industrial categories for United States to 1980 published by other competent economists were used as a framework for the California and southern counties projections. Projections of employment in the same industrial categories in California and the nine southern counties then were established. These were derived from analyses of significant local factors affecting future growth of those activities and probable rates of employment increases in each category in the Nation, California, and the southern counties.

Further details of the population and employment projections will be described in the Department's report.

All projections by the Department are predicated on the assumption that no all-out war, widespread disaster, or prolonged economic depression will occur during the time periods thereof.

Economists seldom are in complete agreement on all details of future growth. I, too, might question a few of the minor details of the Department's studies. In the larger view, however, the median projections of population and civilian employment in California and the nine southern counties developed by the Department of Water Resources are reasonable and supported by logical assumptions and statistical procedures. As such, they should be valid for use in estimating the future water demands required for this investigation. They also should be of interest to public officials, business firms and individuals throughout the State.

COPY

STATEMENT OF DR. E. T. GRETHER TO
CALIFORNIA WATER COMMISSION
DECEMBER 5, 1958

Mr. Chairman, Members of the Commission: May I begin qualifying myself by indicating that I am the Dean of the Graduate School of Business Administration in Berkeley. I wish to avoid jurisdictional confusion in this part of the State.

I have lived in California thirty-six years, I believe it is, and during this period have observed and participated in the industrial and economic development of this State, and my comments today will bear some reference to that thirty-six years of systematic observation of what has taken place in this State. This has been an area of central interest so far as I am concerned.

Now, my area of consulting responsibility in this project is the interrelation between the projected population growth in California and especially in southern California, and industrial expansion, conceived in terms of growth in the leading categories of employment. Before I discuss this area, I would like to make a general comment about the performance of the research staff, and may I say, incidentally, that no one has seen my statement except Professor Weeks on the plane coming down here this morning.

The research staff on the project is comprised of able, energetic, dedicated persons who have been working earnestly and effectively on this highly important and difficult assignment. In addition to their own resources, they have drawn upon outside advice. The research staff has developed a tremendous background in research experience, materials, knowledge, and assembled judgments. Although much of this background will not show itself in detail in the printed pages of reports, it has affected and will affect the quality of the analysis.

As the group has worked along, the leaders have developed a background and capability for forming independent judgments which they are prepared to defend, in my judgment. On the whole the conclusions are in accord with those of recognized technical experts and authorities. Occasional variations from received opinions are well defended in terms of the investigations of the research staff members themselves.

Almost invariably in the past analysts have been too conservative in forecasting the rate of population growth and industrial expansion in the State of California. I also have made my mistakes in this area. For example, I made a study of the steel and steel-using industries of California at the end of World War II, at the request of the State Reemployment and Reconstruction Commission, in cooperation with leading steel companies. In this report we underestimated the population growth and the industrial demand basis for steel in California and West. In fact, I might say I was embarrassed. The report was hardly out for review before California caught up with our forecasts. In the postwar period, California has moved forward more rapidly than was anticipated.

The projections presented in this report have been done carefully but one must realize that they suffer the limitations of all projections of the future, especially when one attempts to look ahead beyond 1980 into the beginning of the next century. We shall be much wiser once we have the benefit of hindsight in relation to our present foresight.

The projections have been made on two bases: first, population in relation to the forecasted United States growth of population and the elements of that population growth; and second, employment in broad industry groupings. These two types of projections obviously are interrelated, as has been noted by previous speakers, although they have been made independently. The projections by broad groupings have been checked by reference to a general interpretive analysis of the pattern of growth, the basic long-run trends of growth in this State, and the judgments of qualified expert observers in industry, Government, and in professional research.

The projections of population and employment for the United States and the State as a whole have been related to those of individual regions in California, including the 9-county region in the south. The employment and industrial projections of the present pattern and outlook check out approximately with the median population projection when translated into terms of total population, as was noted already this morning.

The magnitudes and the patterns of forecasts of economic development in California and in southern California are entirely conservative, even though they may seem almost frightening from the present vantage point. There seems to be no good reason now to envisage future needs on a more conservative basis.

The trends and outlook in terms of the broad groupings of employment are arenas for some differences of opinion and debate, especially when one tries to look ahead more than twenty years, as Mr. Stanbery has already pointed out, but in terms of the problem of water needs and demands, differences of judgment as among broad areas of employment, are not significant. The total magnitude is most important. A very sizable proportion of total employment is related directly to population, even as also is the demand for urban water. The presence of people generates economic demand, and hence employment in the numerous residentiary and home market fields of employment. The continuing expansion of population in conjunction with the increasingly complex agglomeration of industries, enhances the base of industrial opportunities. This enlarging local and regional base provides stronger footing for those industries exporting into western and national and world markets.

There can be little doubt that California and southern California can and will support the population projected unless there are unexpected general limiting factors within the State and the southern California area. One such general limiting factor might well be the availability of land. This factor has been checked out by the research staff and the conclusion has been reached that land will be available for the various uses described. Another general limiting factor could be water - but this is what the project is all about.

Another group of potential limiting factors is related to the provision of basic community services, facilities, and conditions such as highways and transportation facilities in general, sewage disposal, schools, zoning regulations, et cetera. We must assume that the combination of independent, private, and cooperative and coordinated public efforts will continue in the future to provide adequate community services, facilities and conditions for an expanding population and employing industries.

A final group of limiting factors are the conditions and amenities of living derived from climate, the relative purity of the air and the relative congestion and ease of movement of population. We must assume that California and southern California will remain more than competitive on these scores. All regions of the United States are faced with these same general types of potential limitations. But most, if not all, other regions suffer an initial handicap in terms of the amenities of present living in contrast with southern California. In the foreseeable future, California and southern California should continue to be relatively more attractive in terms of general environmental conditions. It does seem reasonable, however, to anticipate a significant relative slowdown of the rate of growth, especially toward the end of this century and in the beginning of the next one, as is done in this study. Possibly, also, at the turn of the century, absolute limits may become evident for some purposes. It is only the course of wisdom now to plan for future needs of the magnitude envisaged in the projections presented in this study.

Thank you, Mr. Chairman.

COPY

DAVID WEEKS
207 GIANNINI HALL
UNIVERSITY OF CALIFORNIA
BERKELEY 4, CALIFORNIA

June 16, 1959

Mr. Harvey O. Banks, Director
State of California
Department of Water Resources
P. O. Box 1079
Sacramento, California

Dear Mr. Banks:

On December 5, 1958, I presented a statement to the California Water Commission meeting in Los Angeles giving my appraisal of the studies made by the Department of Water Resources under the direction of R. M. Edmonston on the growth of economic demand for imported water in Southern California. At the time of that meeting the report on these studies had only reached a rough draft stage, but my familiarity with the investigations as they had proceeded and my frequent work in the Glendale office of the Water Resources Department had given me an opportunity to familiarize myself with the various details of the study and to observe the various specialists in their work as they undertook this gigantic task. Never have I seen an organization so devoted to their work as this self-sacrificing group. Working nights, Sundays, and holidays, they gradually pieced together the various parts of these complex investigations into a single figure -- acre feet of water, which will be required in the year 2020 to be imported into the nine southern counties covered by the study, to supplement developed and undeveloped water supplies existing locally and other imported supplies.

In the many years of my experience with other agencies, such as the United States Bureau of Reclamation, the President's Water Resources Policy

Commission, various water development agencies in foreign countries, and the old California Division of Water Resources, predecessor of the present Department, I have never had the opportunity to review a more outstanding piece of work on demand for water than this one. It is my opinion that no study of a similar kind has ever been made that can compare with it in thoroughness, detail, analytic techniques applied, recognition of theoretical characteristics of demand, at the same time adhering to realistic approaches, all applied to a staggering mass of data accumulated from numerous service areas within which it was compiled. Since the December 5 meeting of the California Water Commission, the report on these studies has been continually worked upon and improved to the point where now, as it is about to go to press, its findings have been firmed up to a point where, notwithstanding recognized difficulties and uncertainties of projecting more than half a century into the future, it represents the best compilation of knowledge that could be asked for, within the time limits imposed, for use as a basis for determining future water development needs.

One of the phases basic both to the determination of future urban and agricultural requirements for water has been the projection of California population broken down into the various regions of the state and, finally, into the detailed service areas of its nine southern counties. Although the results of this population study will be astonishing to those unfamiliar with the changes which have recently taken place in the trends of the basic elements of population growth, two and one-half years of study of the demographic characteristics of national and state population, applying approved methods of analysis of vital statistics and immigration, supplemented by a detailed study of employment and the capacity of the different areas of California to absorb increased population, have resulted in a median projection of total California population for the year 2020 of 56 million people, with reasonable limits of variation therefrom between 44 and 68 millions.

Other steps in the investigations included a detailed inventory of the land and water resources for each of the numerous service areas covered by the study, the breakdown of the above population projection into a most careful estimate of its distribution among these service areas, the estimation of per-capita urban water requirements and area by area variations therein, the application of urban water requirements to population by service areas, observation of the relation of water applied to net water requirements, evaluation of local water supplies, supplemental water requirements, and, finally, demand for imported water for urban use.

Growth in demand for irrigation water was estimated by means of a number of steps which differed quite materially from those used in the projection of urban water requirements and growth in urban demand for imported water. In agriculture probable costs of water to the user, physical adaptability of crops and present and probable future crop patterns in the different areas, market outlook for different crops to be grown under irrigation, urban encroachment upon irrigable areas and the relation of farm income and costs to the limits on amount farmers would be willing and able to pay for water became the major problems for solution in irrigation water projection. But many other details were given consideration. One of the most difficult problems faced in the analysis of future irrigation water requirements was the overdraft of ground water in a number of areas. This problem was made even more difficult by the uncertainty of the future tendency for different local areas to continue overdraught on the existing but temporary supply after the imported supply becomes available.

When all of these estimates were integrated into projections of amounts of imported water required decade by decade, it can be recognized how difficult was the task. Upon these projected water requirements, both urban and agricultural, an aqueduct system was planned and staged.

For the professional ability, integrity and serious assumption of grave responsibility of the group who accomplished this almost impossible task, I have the most profound respect.

Sincerely,

/S/ David Weeks

ATTACHMENT NO. 3

LAND CLASSIFICATION TABLES CONTAINING DATA ON EACH SUBUNIT

TABLE 62

CLASSIFICATION OF IRRIGABLE AND HABITABLE LANDS IN SAN LUIS OBISPO COUNTY

(Net areas in acres)

	Subunit	Irrigable or habitable							Lands not susceptible of development	Total land areas
		Valley lands	Gently sloping hill lands	Steeply sloping hill lands	Urban lands	Agri-cultural resi-dential lands	Miscel-laneous lands	Subtotal		
1.	San Simeon	110	180	260	7,940	0	700	9,190	65,160	74,350
2.	Adelaida	490	2,580	1,460	0	0	0	4,530	110,540	115,070
3.	Camp Roberts	1,580	4,050	780	0	0	0	6,410	20,240	26,650
4.	Shandon	5,540	13,550	6,200	0	0	0	25,290	93,830	119,120
5.	Cholame	6,020	3,540	2,590	0	0	940	13,090	38,780	51,870
6.	Carrizo	72,580	43,460	5,890	0	0	13,330	135,260	199,110	334,370
7.	San Juan	10,580	13,180	4,340	0	0	10	28,110	267,600	295,710
8.	Pozo	840	1,260	460	0	0	0	2,560	44,710	47,270
9.	Margarita	3,510	5,760	5,600	1,310	0	0	16,180	72,390	88,570
10.	Creston	3,960	9,100	10,270	0	0	0	23,330	96,020	119,350
11.	Paso Robles	6,190	10,930	9,020	3,230	0	0	29,370	22,960	52,330
12.	Templeton	1,180	5,550	7,780	5,400	0	0	19,910	85,400	105,310
13.	Cayucos	2,250	1,690	1,610	7,660	0	100	13,310	93,250	106,560
14.	Morro Bay	2,680	3,220	2,920	7,410	0	1,760	17,990	32,160	50,150
15.	Camp San Luis Obispo	420	1,070	1,170	0	0	0	2,660	12,370	15,030
16.	Diablo	0	510	220	1,790	0	240	2,760	25,090	27,850
17.	San Luis Obispo	3,100	4,860	4,700	16,800	0	70	29,530	42,930	72,460
18.	Pismo Beach	4,950	3,270	8,080	6,750	90	1,060	24,200	54,880	79,080
19.	Huasna	4,120	2,590	4,860	0	0	0	11,570	168,160	179,730
20.	Cuyama	12,920	4,450	570	0	0	0	17,940	100,180	118,120
21.	Nipomo	1,600	13,970	13,700	1,210	0	1,180	31,660	26,300	57,960
22.	Santa Maria[a]	9,350	290	0	0	0	110	9,750	3,130	12,880
	TOTALS	153,970	149,060	92,480	59,500	90	19,500	474,600	1,675,190	2,149,790

a. San Luis Obispo County portion of the Santa Maria Valley Water Conservation District.

TABLE 63

CLASSIFICATION OF IRRIGABLE AND HABITABLE LANDS IN SANTA BARBARA COUNTY

(Net areas in acres)

	Subunit	Irrigable or habitable					Lands not susceptible of development	Total land areas
		Urban lands	Agricultural residential lands	Miscellaneous lands	Undifferentiated irrigable or habitable lands	Subtotal		
22.	Santa Maria[a]	7,300	0	0	24,540	31,840	7,020	38,860
23.	Orcutt	20,650	0	0	11,040	31,690	38,990	70,680
24.	Suey	0	0	0	700	700	39,360	40,060
25.	Sisquoc	0	0	0	8,770	8,770	50,430	59,200
26.	Vandenberg	0	0	89,970	0	89,970	0	89,970
27.	Los Alamos	400	0	0	14,020	14,420	37,970	52,390
28.	La Zaca	0	0	0	11,140	11,140	53,210	64,350
29.	Lompoc	4,170	0	0	17,430	21,600	41,930	63,530
30.	Santa Rita	1,420	0	0	4,490	5,910	26,580	32,490
31.	Santa Ynez	14,540	0	0	12,110	26,650	69,660	96,310
32.	Cachuma	0	0	0	9,710	9,710	53,320	63,030
33.	Conception	0	0	0	6,960	6,960	84,460	91,420
34.	Gaviota	2,420	12,920	0	0	15,340	15,530	30,870
35.	Goleta	16,630	5,310	0	0	21,940	9,790	31,730
36.	Santa Barbara	10,390	110	0	0	10,500	6,900	17,400
37.	Montecito	5,660	1,680	0	0	7,340	5,560	12,900
38.	Summerland	200	570	0	0	770	0	770
39.	Carpinteria	2,080	5,800	0	0	7,880	8,770	16,650
40.	Cuyama	0	0	0	35,380	35,380	74,430	109,810
41.	Los Padres National Forest	0	0	0	0	0	647,580	647,580
	TOTALS	85,860	26,390	89,970	156,290	358,510	1,271,490	1,630,000

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[a] Santa Barbara County portion of Santa Maria Valley Water Conservation District.

TABLE 64

CLASSIFICATION OF IRRIGABLE AND HABITABLE LANDS IN VENTURA COUNTY

(Net areas in acres)

Subunit	Irrigable or habitable					Lands not susceptible of development	Total land areas
	Urban lands	Agri-cultural resi-dential lands	Miscel-laneous lands	Undiffer-entiated irrigable or habitable lands	Subtotal		
42. Ventura River Municipal Water District	14,580	3,250	1,580	260	19,670	65,940	84,610
43. United Water Conservation District	77,560	22,040	6,050	2,990	108,640	102,570	211,210
44. Calleguas Municipal Water District	49,560	21,210	0	4,180	74,950	103,640	178,590
45. Topa Topa	0	0	0	0	0	609,090	609,090
46. Sulphur Mountain	1,040	0	150	830	2,020	29,050	31,070
47. Santa Susana	0	170	0	890	1,060	12,070	13,130
48. Malibu	4,450	50	0	420	4,920	48,380	53,300
TOTALS	147,190	46,720	7,780	9,570	211,260	970,740	1,182,000

TABLE 65

CLASSIFICATION OF IRRIGABLE AND HABITABLE LANDS IN COASTAL SAN DIEGO COUNTY[a]

(Net areas in acres)

Subunit	Irrigable or habitable							Lands not susceptible of development	Total land areas
	Valley lands	Gently sloping hill lands	Steeply sloping hill lands	Urban lands	Agricultural residential lands	Miscellaneous lands	Subtotal		
85. Bueno Colorado Municipal Water District	380	3,630	5,180	31,590	20	0	40,800	10,900	51,700
86. Carlsbad Municipal Water District	920	2,410	3,500	12,370	0	0	19,200	1,430	20,630
87. Escondido	0	0	0	1,850	90	0	1,940	0	1,940
88. Fallbrook	30	690	2,380	6,390	0	0	9,490	6,650	16,140
San Diego Metropolitan Area[b]	0	0	0	225,000	0	0	225,000	0	225,000
	(Entire San Diego Metropolitan Area classified as urban)								
96. Oceanside	770	0	10	7,090	0	0	7,870	340	8,210
97. Poway Municipal Water District	1,570	2,330	3,340	1,500	0	0	8,740	2,800	11,540
98. Rainbow Municipal Water District	2,380	6,840	15,280	3,140	0	0	27,640	7,750	35,390
99. Rincon del Diablo Municipal Water District	310	2,400	5,520	10,840	950	0	20,020	2,370	22,390
100. San Dieguito Irrigation District	20	20	10	3,580	490	0	4,120	440	4,560
101. Santa Fe Irrigation District	160	140	680	8,330	170	0	9,480	770	10,250
102. Valley Center Municipal Water District	2,930	11,110	12,290	3,200	0	0	29,530	25,660	55,190
103. Ramona Municipal Water District	2,980	12,690	1,390	610	0	0	17,670	5,430	23,100

LANDS IN COASTAL SAN DIEGO COUNTY[a]
(continued)

(Net areas in acres)

Subunit		Irrigable or habitable							Lands not susceptible of development	Total land areas
		Valley lands	Gently sloping hill lands	Steeply sloping hill lands	Urban lands	Agricultural residential lands	Miscellaneous lands	Subtotal		
104.	Rancho El Cajon	710	430	460	7,280	0	0	8,880	7,630	16,510
105.	Pauma Valley	2,080	3,120	1,660	0	0	0	6,860	5,890	12,750
106.	North of Santa Fe	0	1,650	4,520	30	0	0	6,200	3,330	9,530
107.	East of San Dieguito	1,080	3,070	1,600	1,910	0	0	7,660	1,620	9,280
108.	Near Oceanside	4,280	4,090	2,810	3,100	0	0	14,280	240	14,520
109.	South of Lake Hodges	550	5,440	10,120	990	0	0	17,100	15,780	32,880
110.	East of Del Mar	6,070	6,420	11,040	5,470	0	0	29,000	10,270	39,270
111.	Lower Pauma Valley	3,530	4,110	2,760	0	0	0	10,400	14,890	25,290
112.	Jamul	1,320	6,320	12,690	2,160	0	0	22,490	52,670	75,160
113.	Loveland	340	4,430	6,350	0	0	0	11,120	36,060	47,180
114.	Potrero	760	3,110	4,700	0	0	0	8,570	22,800	31,370
115.	Morena	9,000	0	0	0	0	0	9,000	37,000	46,000
116.	Live Oak	9,000	0	0	0	0	0	9,000	16,000	25,000
117.	El Capitan	840	2,390	5,280	8,930	0	0	17,440	34,370	51,810
118.	Cuyamaca	500	0	0	0	0	0	500	257,500	258,000
119.	Rincon	2,730	3,390	7,170	0	0	0	13,290	20,290	33,580
120.	San Vicente	1,720	7,930	8,460	0	0	0	18,110	51,890	70,000
121.	South Sutherland	380	3,990	3,820	0	0	0	8,190	14,520	22,710
122.	Guejito	2,310	10,720	11,870	20	0	0	24,920	50,270	75,190
123.	Sutherland	20,000	0	0	0	0	0	20,000	55,000	75,000
124.	Henshaw	11,000	0	0	0	0	0	11,000	58,000	69,000
125.	Agua Tibia	50	740	890	1,470	0	380	3,530	34,940	38,470
126.	Palomar	7,000	0	0	0	0	0	7,000	60,000	67,000

CLASSIFICATION OF IRRIGABLE AND HABITABLE LANDS IN COASTAL SAN DIEGO COUNTY[a]
(continued)

(Net areas in acres)

Subunit	Irrigable or habitable							Lands not susceptible of development	Total land areas
	Valley lands	Gently sloping hill lands	Steeply sloping hill lands	Urban lands	Agri-cultural resi-dential lands	Miscel-laneous lands	Subtotal		
127. Chihuahua	3,000	0	0	0	0	0	3,000	53,000	56,000
128. North of Pendleton	4,600	0	0	0	0	0	4,600	30,400	35,000
TOTALS	105,300	113,610	145,780	346,850	1,720	380	713,640	1,008,900	1,722,540

a. Includes that portion of coastal San Diego County as reported in Bulletin No. 61, "Investigation of Alternative Aqueduct Routes to San Diego County", but excludes 173,000 gross acres within Camp Elliott and Camp Pendleton Military Reservations.

b. San Diego Metropolitan Area includes: (89) Rio San Diego Municipal Water District, (90) Helix Irrigation District, (91) South Bay and National City, (92) San Diego, (93) Otay Municipal Water District, (94) Imperial, and (95) Near Miramar.

TABLE 66

CLASSIFICATION OF IRRIGABLE AND HABITABLE LANDS IN COASTAL RIVERSIDE COUNTY

(Net areas in acres)

Subunit	Irrigable or habitable							Lands not susceptible of development	Total land areas
	Valley lands	Gently sloping hill lands	Steeply sloping hill lands	Urban lands	Agricultural residential lands	Miscellaneous lands	Subtotal		
136. Winchester South	34,090	14,910	6,200	3,880	10	0	59,090	31,320	90,410
137. Temescal Canyon	2,180	2,500	1,590	1,750	0	0	8,020	7,980	16,000
138. Lake Elsinore	4,220	1,960	660	8,570	750	0	16,160	12,840	29,000
139. Corona	2,270	670	460	21,770	0	0	25,170	7,820	32,990
140. Jurupa	1,460	0	0	29,120	0	0	30,580	5,310	35,890
141. Riverside	730	0	0	31,070	7,160	0	38,960	10,720	49,680
142. Woodcrest	0	0	0	24,060	3,470	0	27,530	9,900	37,430
143. Lake Mathews	50	730	810	180	0	0	1,770	5,290	7,060
144. Sunnymead	1,390	230	0	21,070	0	0	22,690	4,080	26,770
145. Perris Valley	9,530	1,710	340	21,280	0	0	32,860	1,530	34,390
146. San Jacinto	12,940	1,780	450	19,480	0	0	34,650	6,710	41,360
147. Lake View	17,710	4,510	210	0	0	0	22,430	2,350	24,780
148. Sitton Peak	0	10	0	320	0	0	330	4,000	4,330
149. Santa Ana	120	980	290	10	0	0	1,400	28,960	30,360
150. Steele	110	600	460	1,380	0	0	2,550	7,390	9,940
151. Cajalco	170	4,910	3,190	10,440	0	0	18,710	23,040	41,750
152. Russell	2,210	2,260	330	0	0	0	4,800	4,270	9,070
153. Juniper	10	1,770	710	0	0	0	2,490	9,180	11,670
154. San Timoteo	2,970	9,040	3,360	3,290	6,660	0	25,320	43,930	69,250
155. Idyllwild	5,280	6,600	6,720	20	0	3,930	22,550	163,670	186,220
156. March Air Force Base	0	0	0	0	0	0	0	6,690	6,690
SUBTOTALS	97,440	55,170	25,780	197,690	18,050	3,930	398,060	396,980	795,040

CLASSIFICATION OF IRRIGABLE AND HABITABLE LANDS IN COASTAL RIVERSIDE COUNTY
(continued)

(Net areas in acres)

Subunit	Irrigable or habitable							Lands not susceptible of development	Total land areas
	Valley lands	Gently sloping hill lands	Steeply sloping hill lands	Urban lands	Agri-cultural residential lands	Miscel-laneous lands	Subtotal		
Southwestern Riverside County*	27,410	40,720	17,640	0	0	0	85,770	263,440	349,210
TOTALS	124,850	95,890	43,420	197,690	18,050	3,930	483,830	660,420	1,144,250

*Includes subunits (131) Anza, (132) Cottonwood, (133) Temecula, (134) Vail, (135) Murrieta.

TABLE 67

CLASSIFICATION OF IRRIGABLE AND HABITABLE LANDS IN COASTAL SAN BERNARDINO COUNTY

(Net areas in acres)

	Subunit	Irrigable or habitable							Lands not susceptible of development	Total land areas
		Valley lands	Gently sloping hill lands	Steeply sloping hill lands	Urban lands	Agricultural residential lands	Miscellaneous lands	Subtotal		
157.	Fontana	20	230	0	44,240	30	0	44,520	3,760	48,280
158.	Cucamonga	0	0	0	12,730	2,770	0	15,500	610	16,110
159.	Ontario	590	0	0	38,780	0	0	39,370	2,010	41,380
160.	Los Serranos	0	20	30	25,520	0	0	25,570	10,880	36,450
161.	Colton	3,660	30	40	64,890	0	0	68,620	12,720	81,340
162.	Redlands	0	0	0	29,290	0	0	29,290	14,550	43,840
163.	Yucaipa	1,590	2,590	590	7,770	0	0	12,540	5,350	17,890
164.	Chino Hills	40	40	20	1,310	0	0	1,410	9,290	10,700
165.	San Antonio	1,700	6,600	1,370	5,770	230	470	16,140	107,160	123,300
166.	Big Bear	360	3,300	2,390	490	0	14,240	20,780	209,540	230,320
	TOTALS	7,960	12,810	4,440	230,790	3,030	14,710	273,740	375,870	649,610

TABLE 68

CLASSIFICATION OF IRRIGABLE AND HABITABLE LANDS IN THE KERN COUNTY SERVICE AREA

(Net areas in acres)

Region	Irrigable or habitable					Lands not susceptible of development	Total land areas
	Valley lands	Gently sloping hill lands	Steeply sloping hill lands	Urban lands	Subtotal		
Antelope Plain	293,350	34,700	6,550	180	334,780	9,460	344,240
Buena Vista Water Storage District	77,840	190	460	300	78,790	390	79,180
Semitropic Water Storage District	222,750	0	0	0	222,750	1,430	224,180
Taft Area	46,090	13,730	3,870	3,190	66,880	6,430	73,310
Maricopa-Wheeler Ridge Water Storage District	118,700	3,120	980	30	122,830	4,690	127,520
Kern River Delta	264,270	110	0	2,150	266,530	1,370	267,900
Rosedale-Rio Bravo Water Storage District*	(42,280)	0	0	(500)	(42,780)	(220)	(43,000)
Bakersfield Urban Area	0	0	0	69,540	69,540	1,130	70,670
TOTALS	1,023,000	51,850	11,860	75,390	1,162,100	24,900	1,187,000

*Note: Already tabulated in Kern River Delta.

TABLE 69

CLASSIFICATION OF IRRIGABLE AND HABITABLE LANDS IN THE ANTELOPE-MOJAVE SERVICE AREA[a]

(Net areas in acres)

Subunit		Undifferentiated irrigable or habitable lands	Lands not susceptible of development	Total land areas
173.	Mojave	304,650	167,140	471,790
174.	Boron	207,810	26,940	234,750
175.	Edwards Air Force Base	39,950	154,050	194,000
176.	Rand	306,640	284,420	591,060
177.	Neenach	74,960	86,550	161,510
178.	Lancaster	199,300	7,950	207,250
179.	Buttes	233,360	800	234,160
180.	Littlerock	124,580	5,350	129,930
181.	Mirage	221,700	11,160	232,860
182.	Victorville	297,600	65,480	363,080
183.	Lucerne Valley	116,050	72,470	188,520
184.	Cuddeback	288,960	374,630	663,590
185.	Barstow	535,300	251,440	786,740
186.	Ord Mountain	198,280	225,480	423,760
	TOTALS	3,149,140	1,733,860	4,883,000

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a. Includes portions of Kern, Los Angeles, and San Bernardino Counties.

ATTACHMENT NO. 4

LAND USE TABLES CONTAINING DATA ON EACH SUBUNIT

TABLE 70

PRESENT LAND USE IN THE SAN LUIS OBISPO SERVICE AREA

(Net areas in acres)

Hydrologic unit and Subunit	Irrigated lands							Urban, suburban and military[a]	Total water service area
	Alfalfa	Pasture	Deciduous fruits nuts and vines	Citrus and sub-tropical	Truck crops	Field crops	Subtotal		
Upper Salinas Unit	6,870	2,660	20	0	370	580	10,500	1,340	11,840
Coastal Unit									
Cambria Subunit	110	370	50	0	0	550	1,080	160	1,240
San Luis Obispo Subunit	630	860	70	0	700	400	2,660	3,280	5,940
Arroyo Grande Subunit	150	210	350	0	2,820	210	3,740	880	4,620
Santa Maria Unit[b]	530	880	0	0	3,690	960	6,060	60	6,120
Cuyama Unit	1,550	140	0	0	0	2,360	4,050	0	4,050
Carrizo Plain Unit	30	110	0	0	0	180	320	10	330
TOTALS	9,870	5,230	490	0	7,580	5,240	28,410	5,730	34,140

Note: Field Survey made in 1953.

a. Large military reservations in San Luis Obispo County not tabulated.

b. There are 7,290 irrigated acres in the Santa Maria Valley Water Conservation District within San Luis Obispo County tabulated with Santa Barbara County.

TABLE 71

PRESENT LAND USE IN THE SANTA BARBARA SERVICE AREA

(Gross areas in acres)

	Subunit	Irrigated lands									Urban, suburban and military[a]	Total water service area
		Alfalfa	Pasture	Deciduous fruits nuts and vines	Citrus and subtropical	Sugar beets	Truck crops	Field crops	Miscellaneous	Subtotal		
22.	Santa Maria Valley Water Conservation District	2,520	3,020	10	0	2,230	20,800	4,110	440	33,130[b]	2,000	35,130
23.	Orcutt	180	540	10	0	160	1,350	240	160	2,640	1,160	3,800
24.	Suey	20	0	0	0	0	0	100	0	120	0	120
25.	Sisquoc	480	150	0	0	100	560	60	10	1,360	0	1,360
26.	Vandenberg	140	40	0	0	110	250	110	0	650	0	650
27.	Los Alamos	220	90	10	0	450	850	370	0	1,990	60	2,050
28.	La Zaca	80	300	80	0	80	0	230	30	800	0	800
29.	Lompoc	580	840	380	0	1,290	3,200	4,170	60	10,520	760	11,280
30.	Santa Rita	30	60	90	0	60	60	400	0	700	0	700
31.	Santa Ynez	1,720	1,220	880	10	740	630	1,330	250	6,780	330	7,110
32.	Cachuma	20	80	0	0	0	0	0	20	120	0	120
33.	Conception	30	50	10	10	0	0	0	20	120	0	120
34.	Gaviota	0	140	470	1,200	0	260	70	0	2,140	160	2,300
35.	Goleta	0	120	720	5,010	0	560	90	260	6,760	1,140	7,900
36.	Santa Barbara	0	0	0	130	0	370	0	320	820	4,740	5,560
37.	Montecito	0	30	10	1,280	0	60	0	220	1,600	1,790	3,390
38.	Summerland	0	0	0	80	0	0	0	0	80	50	130
39.	Carpinteria	0	0	30	3,860	0	360	30	140	4,420	420	4,840
40.	Cuyama	1,980	280	0	0	240	40	1,300	80	3,920	170	4,090
	TOTALS	8,000	6,960	2,700	11,580	5,460	29,350	12,610	2,010	78,670	12,780	91,450

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a. Large military reservations in Santa Barbara County not tabulated. Note: Field survey made in 1957.

b. Includes 7,290 irrigated acres of the Santa Maria Valley Water Conservation District that are within San Luis Obispo County.

TABLE 72

PRESENT LAND USE IN VENTURA COUNTY SERVICE AREA

(Gross areas in acres)

Subunit	Irrigated lands							Urban, suburban and military	Total water service area
	Alfalfa	Pasture	Deciduous fruits nuts and vines	Citrus and subtropical	Truck crops	Field crops	Subtotal		
42. Ventura River Municipal Water District	260	250	1,830	2,940	1,500	360	7,140	5,180	12,320
43. United Water Conservation District	820	510	5,230	32,000	27,970	1,530	68,060	16,040	84,100
44. Calleguas Municipal Water District	950	530	9,430	15,430	17,230	1,420	44,990	3,370	48,360
45. Topatopa	0	0	0	0	0	0	0	0	0
46. Sulphur Mountain	0	0	120	20	0	0	140	230	370
47. Santa Susana	0	20	260	1,250	10	40	1,580	380	1,960
48. Malibu	40	150	340	460	360	0	1,350	840	2,190
TOTALS	2,070	1,460	17,210	52,100	47,070	3,350	123,260	26,040	149,300

Note: Field Survey made in 1957.

TABLE 73

PRESENT LAND USE IN COASTAL LOS ANGELES COUNTY[a]

(Gross areas in acres)

Hydrologic unit	Irrigated lands							Urban, suburban and military	Total water service area
	Alfalfa	Pasture	Deciduous fruits nuts and vines	Citrus and subtropical	Truck crops	Field crops	Subtotal		
San Fernando	3,400	5,100	2,300	7,500	4,200	1,200	23,700	78,500	102,200
San Gabriel	1,000	3,400	1,600	15,400	4,200	900	26,500	84,000	110,500
Pomona	200	300	300	3,700	300	300	5,100	7,700	12,800
Coastal Plain	800	11,300	400	4,800	8,600	1,600	27,500	283,300	310,800
Malibu	0	100	0	0	400	0	500	3,000	3,500
Upper Santa Clara Valley	3,410	800	610	70	2,610	900	8,400	1,420	9,820
TOTALS	8,810	21,000	5,210	31,470	20,310	4,900	91,700	457,920	549,620

a. Water service areas herein are summation of 1957 field survey in Upper Santa Clara Valley and 1955 field survey in coastal plain.

TABLE 74

PRESENT LAND USE IN ORANGE COUNTY

(Gross areas in acres)

Subunit	Irrigated lands								
	Alfalfa	Pasture	Deciduous fruits nuts and vines	Citrus and sub-tropical	Truck crops	Field crops	Subtotal	Urban, suburban and military	Total water service area
77. Fullerton	0	0	10	2,910	180	40	3,140	6,360	9,500
78. Anaheim	0	40	180	4,000	420	20	4,660	7,440	12,100
79. Santa Ana	0	0	10	1,830	140	610	2,590	6,080	8,670
80. Orange County Municipal Water District	2,330	4,140	900	39,680	19,300	20,400	86,750	39,190	125,940
81. Coastal	0	60	0	350	140	0	550	9,340	9,890
Unorganized Areas[a]	250	50	10	2,150	1,190	440	4,090	760	4,850
TOTALS	2,580	4,290	1,110	50,920	21,370	21,510	101,780	69,170	170,950

[a] Includes areas: (82), Laguna Canyon; (83), San Juan Capistrano; (84), Santiago.

Note: Field Survey made in 1957.

TABLE 75

PRESENT LAND USE IN COASTAL RIVERSIDE COUNTY[a]

(Gross areas in acres)

Subunit	Irrigated lands								Urban, suburban and military	Total water service area
	Alfalfa	Pasture	Deciduous fruits nuts and vines	Citrus and subtropical	Truck crops	Field crops	Miscellaneous	Subtotal		
136. Winchester South	2,290	880	40	30	2,440	4,880	0	10,560	900	11,460
137. Temescal Canyon	80	0	10	1,120	0	0	0	1,210	270	1,480
138. Lake Elsinore	0	150	1,380	830	480	70	0	2,910	1,820	4,730
139. Corona	140	640	150	5,040	1,200	60	0	7,230	2,580	9,810
140. Jurupa	1,680	3,190	2,610	400	5,260	400	0	13,540	3,780	17,320
141. Riverside	1,340	1,470	460	7,860	1,290	380	0	12,800	11,010	23,810
142. Woodcrest	110	140	60	3,850	190	80	0	4,430	1,340	5,770
143. Lake Mathews	0	0	0	0	0	0	0	0	10	10
144. Sunnymead	40	260	440	1,220	1,450	70	0	3,480	700	4,180
145. Perris Valley	2,220	220	180	30	3,270	1,880	0	7,800	820	8,620
146. San Jacinto	2,610	2,670	4,830	2,060	2,250	2,460	0	16,880	2,960	19,840
147. Lakeview	1,570	360	70	30	2,300	1,780	0	6,110	220	6,330
148. Sitton Peak	0	0	0	0	0	0	0	0	0	0
149. Santa Ana	0	0	20	470	10	0	0	500	20	520
150. Steele	0	0	0	30	0	0	0	30	40	70
151. Cajalco	0	0	10	40	0	0	0	50	140	190
152. Russell	20	0	0	0	60	0	0	80	0	80
153. Juniper	0	40	0	0	0	0	0	40	40	80
154. San Timoteo	340	530	2,350	70	0	10	0	3,300	1,580	4,880
155. Idyllwild	0	10	70	60	0	40	0	180	100	280
156. March Air Force Base	0	0	0	0	0	0	0	0	860	860
Southwestern Riverside County[a]	0	4,000	160	320	2,000	470	790	7,740	350	8,090
TOTALS	12,440	14,560	12,840	23,460	22,200	12,580	790	98,870	29,540	128,410

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a. Includes subunits (131) Anza, (132) Cottonwood, (133) Temecula, (134) Vail, (135) Murrieta.

Note: Field Survey made in 1957.

TABLE 76

PRESENT LAND USE IN COASTAL SAN BERNARDINO COUNTY

(Gross areas in acres)

	Subunit	Irrigated lands							Urban, suburban and military	Total water service area
		Alfalfa	Pasture	Deciduous fruits nuts and vines	Citrus and sub-tropical	Truck crops	Field crops	Subtotal		
157.	Fontana	0	130	7,950	2,450	680	50	11,260	6,740	18,000
158.	Cucamonga	0	0	930	4,400	340	0	5,670	1,240	6,910
159.	Ontario	1,540	2,180	1,460	6,310	5,740	1,040	18,270	12,520	30,790
160.	Los Serranos	1,580	2,660	2,480	0	6,360	510	13,590	1,640	15,230
161.	Colton	480	2,450	3,900	6,870	1,190	140	15,030	23,110	38,140
162.	Redlands	310	510	90	15,360	490	380	17,140	5,100	22,240
163.	Yucaipa	160	90	2,330	400	140	0	3,120	2,060	5,180
164.	Chino Hills	0	0	0	90	0	0	90	0	90
165.	San Antonio	0	110	530	30	50	0	720	620	1,340
166.	Big Bear	10	20	500	390	0	0	920	560	1,480
	TOTALS	4,080	8,150	20,170	36,300	14,990	2,120	85,810	53,590	139,400

Note: Field Survey made in 1957.

TABLE 77

PRESENT LAND USE IN THE KERN COUNTY SERVICE AREA

(Gross areas in acres)

Region	Orchard and vineyard	Alfalfa and pasture	Potatoes	Cotton	Miscellaneous truck and field crops	Subtotal	Urban, suburban and military	Total water service area
Antelope Plain	65	410	0	2,498	12,998	15,971	165	16,136
Buena Vista Water Storage District	6	8,337	322	21,354	34,936	64,955	591	65,546
Semitropic Water Storage District	3	20,043	1,597	30,445	19,831	71,919	327	72,246
Taft area	0	170	0	787	79	1,036	2,321	3,357
Maricopa-Wheeler Ridge Water Storage District	141	15,661	4,221	17,573	10,110	47,706	1,878	49,584
Kern River Delta*	3,157	39,711	4,139	30,506	36,649	114,162	3,797	117,959
Rosedale-Rio Bravo Water Storage District	112	9,211	66	7,150	5,917	22,456	348	22,804
Bakersfield urban area	78	6,126	328	4,274	4,261	15,067	19,913	34,980
TOTALS	3,562	99,669	10,673	114,587	124,781	353,272	29,340	382,612

*Includes 666 acres exclusion within boundaries of Rosedale-Rio Bravo.

TABLE 78

PRESENT LAND USE IN THE ANTELOPE-MOJAVE SERVICE AREA[a]

(Gross areas in acres)

Subunit	Irrigated lands								Urban, suburban and military[b]	Total water service area
	Alfalfa	Pasture	Deciduous fruits nuts and vines	Citrus and sub-tropical	Sugar beets	Truck crops	Field crops	Subtotal		
167. Arrowhead	0	60	0	0	0	0	0	60	0	60
168. Wrightwood	0	0	0	0	0	0	0	0	990	990
173. Mojave	4,980	1,530	10	0	0	300	3,440	10,260	1,290	11,550
174. Boron	2,640	0	0	0	0	0	4,300	6,940	390	7,330
175. Edwards Air Force Base	0	0	0	0	0	0	0	0	120	120
176. Rand	1,970	310	0	0	0	20	2,550	4,850	660	5,510
177. Neenach	1,910	750	30	10	0	1,180	3,520	7,400	150	7,550
178. Lancaster	12,720	5,400	470	0	0	350	4,610	23,550	5,390	28,940
179. Buttes	16,510	4,250	60	0	0	0	6,380	27,200	60	27,260
180. Littlerock	450	820	1,090	0	0	60	180	2,600	110	2,710
181. Mirage	250	0	30	0	0	0	0	280	10	290
182. Victorville	5,240	2,460	40	0	50	50	1,500	9,340	1,450	10,790
183. Lucerne Valley	1,150	1,200	10	0	0	220	400	2,980	100	3,080
184. Cuddeback	10	0	0	0	0	0	10	20	0	20
185. Barstow	4,710	1,200	20	0	0	10	1,570	7,510	1,630	9,140
186. Ord Mountains	130	0	0	0	0	0	0	130	0	130
TOTALS	52,670	17,980	1,760	10	50	2,190	28,460	103,120	12,350	115,470

Note: Field Survey made in 1957

a. Comprises those portions of Kern, San Bernardino and Los Angeles Counties depicted on Plate 2 as Antelope-Mojave Service Area.

b. Large military reservations in the Antelope-Mojave area not tabulated.

TABLE 79

PRESENT LAND USE IN THE WHITEWATER-COACHELLA SERVICE AREA[a]

(Gross areas in acres)

Subunit	Irrigated lands						Urban, suburban and military	Total water service area
	Pasture	Deciduous fruits nuts and vines	Citrus and sub-tropical	Truck crops	Field crops	Subtotal		
169. Palm Springs	870	270	10	40	150	1,340	5,320	6,660
170. Desert Hot Springs	0	0	0	0	0	0	320	320
171. Coachella Valley County Water District	1,160	1,110	2,100	130	250	4,750	2,080	6,830
172. Coachella Valley County Water District Improvement District No. 1	8,810	11,900	12,360	11,170	14,820	59,060	2,850	61,910
TOTALS	10,840	13,280	14,470	11,340	15,220	65,150	10,570	75,720

Note: Field Survey made in 1958.

a. Comprises that portion of Riverside County depicted on Plate 2 as Whitewater-Coachella Service Area.

ATTACHMENT NO. 5

POPULATION GROWTH RATES

TABLE 80

HISTORICAL AND PROJECTED CALIFORNIA GROSS REPRODUCTION RATES

Historical gross reproduction rates			
Year	United States	California	Ratio of California to United States rate
1920	1,648	1,183	0.718
1930	1,260	895	0.710
1940	1,121	962	0.858
1950	1,505	1,464	0.973

Projections of ratio of California to United States rate and California gross reproduction rates				
		California rates		
Period	Ratio	Low	Median	High
1955-59	0.977	1,661	1,710	1,749
1960-64	0.980	1,568	1,666	1,754
1965-69	0.984	1,476	1,614	1,761
1970-74	0.986	1,380	1,583	1,740
1975-79	0.988	1,284	1,551	1,694
1980-84	0.990	1,188	1,500	1,648
1985-89	0.992	1,190	1,453	1,602
1990-94	0.994	1,193	1,402	1,556
1995-99	0.995	1,194	1,353	1,507
2000-04	0.995	1,194	1,298	1,458
2005-09	0.995	1,194	1,244	1,408
2010-14	0.995	1,194	1,234	1,358
2015-19	0.995	1,194	1,234	1,308

TABLE 81

HISTORICAL AND PROJECTED CALIFORNIA GROSS REPRODUCTION RATES AND AGE-SPECIFIC BIRTH RATES

Year	Gross reproduction rate	Age-specific birth rates by five-year age group					
		15-19	20-24	25-29	30-34	35-39	40-44
Historical[a]							
1920	1,183	50.7	145.6	128.7	87.9	52.6	18.1
1930	895	45.2	114.3	95.8	64.1	35.0	11.8
1940	962	48.3	134.2	109.3	64.6	29.4	8.1
1950	1,464	92.0	202.6	159.1	93.1	42.2	11.1
Median projection[b], five-year annual averages							
1955-59	1,710	90.0	234.6	189.6	115.8	58.6	15.8
1960-64	1,666	86.6	226.6	184.2	113.2	57.4	15.8
1965-69	1,614	83.0	217.6	178.2	110.6	56.0	15.8
1970-74	1,583	80.0	212.2	174.4	109.0	55.2	15.6
1975-79	1,551	78.4	206.4	170.8	107.4	54.4	15.6
1980-84	1,500	75.0	198.0	165.0	105.0	53.2	15.6
1985-89	1,453	71.8	189.8	159.6	102.6	52.2	15.6
1990-94	1,402	68.4	181.4	154.4	100.4	51.4	15.6
1995-99	1,353	65.4	173.0	148.8	98.2	50.6	15.6
2000-04	1,298	62.0	164.2	142.8	96.0	49.8	15.6
2005-09	1,244	59.0	155.6	137.0	93.6	48.8	15.6
2010-14	1,234	58.4	153.8	136.0	93.2	48.8	15.6
2015-19	1,234	58.4	153.8	136.0	93.2	48.8	15.6

[a] Source of historical data: W. S. Thompson "Growth and Changes in California's Population", Table III-3.

[b] Median projected gross reproduction rate from Table 80. Age-specific birth rates from Figure 4.

TABLE 82

PROJECTED FIVE-YEAR SURVIVAL RATES FOR THE UNITED STATES POPULATION

(Survivors per 1,000 in the beginning age group)

Female

Age change (years)	Period of change									
	1955-60	1960-65	1965-70	1970-75	1975-80	1980-85	1985-90	1990-95	1995-2000	2000-20
Birth to 0- 4	977.24	979.85	981.99	983.71	985.04	986.02	986.70	987.12	987.31	987.33
0- 4 to 5- 9	996.12	996.36	996.57	996.74	996.90	997.02	997.10	997.16	997.20	997.20
5- 9 to 10-14	998.23	998.32	998.41	998.48	998.54	998.60	998.63	998.66	998.67	998.67
10-14 to 15-19	997.70	997.82	997.93	998.02	998.10	998.16	998.20	998.22	998.24	998.24
15-19 to 20-24	996.64	996.84	997.00	997.14	997.26	997.36	997.42	997.48	997.50	997.50
20-24 to 25-29	995.88	996.14	996.36	996.56	996.72	996.86	996.96	997.02	997.05	997.06
25-29 to 30-34	994.66	995.02	995.35	995.62	995.86	996.04	996.18	996.28	996.32	996.32
30-34 to 35-39	992.32	992.88	993.38	993.80	994.14	994.42	994.64	994.78	994.84	994.86
35-39 to 40-44	988.48	989.30	990.02	990.64	991.15	991.56	991.86	992.07	992.17	992.18
40-44 to 45-49	982.54	983.78	984.86	985.79	986.57	987.18	987.65	987.96	988.12	988.14
45-49 to 50-54	973.80	976.02	977.78	979.17	980.21	980.95	981.44	981.72	981.83	981.84
50-54 to 55-59	961.64	964.83	967.39	969.38	970.88	971.94	972.64	973.03	973.20	973.22
55-59 to 60-64	942.84	947.62	951.48	954.48	956.76	958.38	959.44	960.06	960.32	960.36
60-64 to 65-69	908.39	914.55	920.02	924.78	928.82	932.09	934.58	936.27	937.13	937.24
65-69 to 70-74	859.58	867.90	875.28	881.68	887.08	891.45	894.77	897.01	898.14	898.28
70-74 to 75-79	784.80	796.51	805.94	813.30	818.85	822.82	825.44	826.94	827.59	827.66
75-79 to 80-84	660.36	670.88	680.19	688.26	695.08	700.60	704.78	707.60	709.03	709.21
80-84 to 85+	518.64	530.04	540.02	548.56	555.69	561.39	565.66	568.52	569.94	570.12
85+	314.81	323.90	331.84	338.66	344.33	348.88	352.28	354.55	355.69	355.83

TABLE 83

PROJECTED FIVE YEAR SURVIVAL RATES FOR THE CALIFORNIA POPULATION[a]

(Survivors per 1,000 in the beginning age group)

Age change (years)	Period of change									
	1955-60	1960-65	1965-70	1970-75	1975-80	1980-85	1985-90	1990-95	1995-2000	2000-20
Birth to 0- 4	975.64	977.75	979.84	981.64	983.06	984.10	984.87	985.34	985.56	985.58
0- 4 to 5- 9	995.90	996.01	996.18	996.33	996.49	996.59	996.68	996.75	996.78	996.79
5- 9 to 10-14	997.89	997.91	997.99	998.06	998.12	998.18	998.22	998.25	998.27	998.27
10-14 to 15-19	996.70	996.77	996.87	996.98	997.07	997.14	997.20	997.23	997.26	997.26
15-19 to 20-24	994.36	994.32	994.41	994.59	994.80	995.00	995.19	995.34	995.42	995.43
20-24 to 25-29	993.53	993.56	993.70	993.92	994.13	994.33	994.51	994.65	994.72	994.73
25-29 to 30-34	993.13	993.36	993.65	993.92	994.15	994.32	994.45	994.55	994.59	994.59
30-34 to 35-39	990.87	991.30	991.78	992.21	992.55	992.80	993.00	993.12	993.17	993.18
35-39 to 40-44	986.20	986.82	987.52	988.16	988.68	989.05	989.35	989.54	989.62	989.63
40-44 to 45-49	978.22	979.10	980.14	981.15	982.01	982.64	983.18	983.52	983.69	983.71
45-49 to 50-54	965.67	966.92	968.50	970.04	971.37	972.39	973.25	973.82	974.10	974.13
50-54 to 55-59	948.33	950.05	952.31	954.52	956.48	957.98	959.26	960.11	960.54	960.59
55-59 to 60-64	923.05	925.21	928.35	931.57	934.51	936.83	938.86	940.25	940.96	941.06
60-64 to 65-69	882.59	883.83	887.63	892.46	897.50	902.00	906.21	909.33	911.03	911.26
65+[b]	701.62	701.16	705.38	711.05	716.74	721.10	725.64	728.80	730.45	730.66
California / United States[c]	0.940	0.970	0.984	0.991	0.995	0.998	1.000	1.000	1.000	1.000

a. The age-specific survival rates for California's population were derived from the survival rates for the United States population in Table 82 by first averaging the male and female survival rates, and then adjusting this average by age group according to the ratio between California and United States mortality projected in c. The adjustment was made in this manner.

$$\text{Cal. survival} = 1 - \left[(\text{1-ave. U.S. survival}) \times \text{Ratio } \frac{\text{Cal.}}{\text{U.S.}}\right] \text{ by 5 yr. age groups}$$

b. The survival rate for ages 65+ was computed from the U. S. rates as the weighted average:
5 x (65-69 to 70-74) + 4 x (70-74 to 75-79) + 3 x (75-79 to 80-84) + 2 x (80-84 to 85+) + 1 x (85+)

c. Projected ratio between California and United States age-adjusted mortality rates.

ATTACHMENT NO. 6

DETAILED COHORT-SURVIVAL PROJECTION OF THE UNITED STATES POPULATION

TABLE 84

BIRTH COMPUTATIONS FOR MEDIAN UNITED STATES POPULATION PROJECTION

(In thousands of persons)

Age group	1955	1955 to 1960			1960	1960 to 1965			1965	1965 to 1970			1970	1970 to 1975		
	Number of women	Average number of women	Rate per 1,000*	Number of births	Number of women	Average number of women	Rate per 1,000*	Number of births	Number of women	Average number of women	Rate per 1,000*	Number of births	Number of women	Average number of women	Rate per 1,000*	Number of births
15-19	5,507.0	6,047.6	466.5	2,821.2	6,588.2	7,502.9	446	3,346.2	8,417.7	8,890.4	425	3,778.4	9,363.1	9,670.2	412	3,984.1
20-24	5,371.0	5,476.3	1,210	6,626.3	5,581.6	6,114.4	1,165	7,123.2	6,647.2	7,559.8	1,111	8,398.9	8,472.3	8,944.2	1,080	9,659.7
25-29	5,941.0	5,701.2	971	5,535.8	5,461.4	5,558.9	941	5,230.9	5,656.5	6,188.0	906	5,606.3	6,719.5	7,629.6	885	6,752.2
30-34	6,325.0	6,161.1	590	3,635.0	5,997.2	5,753.4	576	3,313.9	5,509.5	5,607.6	560	3,140.2	5,705.6	6,235.5	550	3,429.5
35-39	5,918.0	6,130.8	299.5	1,836.1	6,343.6	6,177.8	290	1,791.5	6,012.1	5,771.4	284	1,639.0	5,530.6	5,629.2	280	1,576.1
40-44	5,716.0	5,812.1	79.2	460.3	5,908.2	6,117.0	79	483.2	6,325.8	6,164.0	78.8	485.7	6,002.2	5,765.6	78.7	453.7
TOTALS				20,914.9				21,289.2				23,048.7				25,855.5
Male				10,729.3				10,921.3				11,824.0				13,263.8
Female				10,185.5				10,367.8				11,224.7				12,591.6

Age group	1975	1975 to 1980			1980	1980 to 1985			1985	1985 to 1990			1990	1990 to 1995		
	Number of women	Average number of women	Rate per 1,000*	Number of births	Number of women	Average number of women	Rate per 1,000*	Number of births	Number of women	Average number of women	Rate per 1,000*	Number of births	Number of women	Average number of women	Rate per 1,000*	Number of births
15-19	9,977.3	10,080.2	400	4,032.0	10,183.0	10,613.5	380	4,033.1	11,044.0	11,723.1	363	4,255.4	12,402.2	13,021.6	345	4,492.4
20-24	9,416.1	9,723.0	1,055	10,257.7	10,029.8	10,132.9	1,003	10,163.3	10,235.9	10,665.6	960	10,238.9	11,095.3	11,773.0	913	10,748.7
25-29	8,539.7	9,010.7	866	7,803.2	9,481.7	9,788.3	835	8,173.2	10,094.8	10,198.1	805	8,209.4	10,301.4	10,730.1	775	8,315.8
30-34	6,765.4	7,672.6	542	4,158.5	8,579.7	9,049.6	529	4,787.2	9,519.5	9,825.6	516	5,070.0	10,131.6	10,235.0	504	5,158.4
35-39	5,727.8	6,255.6	275	1,720.0	6,783.4	7,686.4	269	2,067.6	8,589.5	9,057.8	263	2,382.2	9,526.1	9,831.2	258	2,536.4
40-44	5,528.9	5,628.0	78.7	442.9	5,727.2	6,251.8	78.5	490.7	6,776.3	7,673.0	78.5	602.3	8,569.7	9,035.2	78.5	709.2
TOTALS				28,414.6				29,715.3				30,758.4				31,961.1
Male				14,576.7				15,243.9				15,779.1				16,396.0
Female				13,837.9				14,471.3				14,979.3				15,565.1

BIRTH COMPUTATIONS FOR MEDIAN
UNITED STATES POPULATION PROJECTION
(continued)

(In thousands of persons)

Age group	1995	1995 to 2000			2000	2000 to 2005			2005	2005 to 2010			2010	2010 to 2015		
	Number of women	Average number of women	Rate per 1,000*	Number of births	Number of women	Average number of women	Rate per 1,000*	Number of births	Number of women	Average number of women	Rate per 1,000*	Number of births	Number of women	Average number of women	Rate per 1,000*	Number of births
15-19	13,641.1	13,959.2	330	4,606.5	14,277.2	14,531.7	312	4,533.8	14,786.2	15,077.0	296	4,462.7	15,367.9	15,743.6	294	4,628.6
20-24	12,450.8	13,068.8	871	11,382.9	13,686.8	14,004.0	825	11,553.3	14,321.3	14,575.2	784	11,426.9	14,829.1	15,119.2	775	11,717.3
25-29	11,158.8	11,834.7	749	8,864.1	12,510.6	13,126.8	718	9,425.0	13,743.1	14,059.4	689	9,686.9	14,375.8	14,628.9	684	10,006.1
30-34	10,338.5	10,765.8	493	5,307.5	11,193.1	11,866.6	481	5,707.8	12,540.0	13,154.0	470	6,182.3	13,767.9	14,083.1	469	6,604.9
35-39	10,136.4	10,239.6	254	2,600.8	10,342.8	10,768.0	250	2,692.0	11,193.2	11,863.2	245	2,906.4	12,533.1	13,144.0	245	3,220.2
40-44	9,500.7	9,804.0	78.0	764.7	10,107.2	10,209.6	78.0	796.3	10,312.1	10,734.0	78.0	837.2	11,155.8	11,820.6	78.0	922.0
TOTALS				33,526.7				34,688.4				35,502.7				37,099.4
Male				17,199.2				17,795.1				18,212.9				19,032.0
Female				16,327.5				16,893.2				17,289.8				18,067.4

Age group	2015	2015 to 2020			2020
	Number of women	Average number of women	Rate per 1,000*	Number of births	Number of women
15-19	16,119.2	16,397.0	294	4,820.7	16,674.8
20-24	15,409.3	15,784.0	775	12,232.6	16,158.7
25-29	14,882.0	15,171.2	684	10,377.1	15,460.5
30-34	14,398.3	14,650.5	469	6,871.0	14,902.7
35-39	13,754.8	14,068.4	245	3,446.7	14,381.9
40-44	12,485.3	13,091.4	78	1,021.1	13,697.4
TOTALS				38,769.3	
Male				19,888.7	
Female				18,880.6	

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*Age-specific-birth rate. Number of births in five years per 1,000 women in the particular five year age group. Annual age-specific-birth rate from Table 8 multiplied by five.

TABLE 85

ESTIMATED AND PROJECTED TOTAL POPULATION
OF THE UNITED STATES, BY AGE GROUP
1955 TO 2020

Median Projection

(In thousands of persons)

Age group:	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
0- 4	19,108.0	20,394.9	20,819.6	22,595.1	25,395.1	27,949.9	29,261.7	30,311.1	31,509.7	33,063.0	34,228.5	35,009.1	36,582.2	38,229.8
5- 9	17,151.0	19,077.1	20,356.1	20,783.7	22,556.5	25,350.2	27,899.5	29,209.4	30,257.4	31,453.1	33,001.6	34,163.3	34,941.4	36,509.4
10-14	13,343.0	17,157.3	19,074.8	20,353.2	20,781.6	22,552.5	25,342.6	27,888.3	29,196.9	30,243.4	31,437.1	32,982.9	34,142.6	34,919.3
15-19	11,191.0	13,370.8	17,163.8	19,077.8	20,354.8	20,784.1	22,551.6	25,335.2	27,874.7	29,180.4	30,224.0	31,414.4	32,955.9	34,112.4
20-24	10,775.0	11,265.6	13,414.1	17,187.5	19,094.8	20,369.5	20,801.2	22,564.1	25,338.2	27,868.0	29,167.9	30,206.7	31,391.6	32,926.0
25-29	11,752.0	10,884.6	11,348.1	13,485.6	17,239.0	19,139.1	20,410.8	20,843.9	22,600.2	25,361.2	27,877.8	29,170.7	30,204.0	31,382.6
30-34	12,400.0	11,828.7	10,949.4	11,414.2	13,542.0	17,276.7	19,169.4	20,436.5	20,869.2	22,616.8	25,362.9	27,865.7	29,151.6	30,179.2
35-39	11,608.0	12,417.2	11,840.5	10,975.7	11,442.2	13,558.3	17,269.8	19,152.7	20,413.4	20,844.2	22,580.0	25,307.3	27,792.9	29,070.0
40-44	11,217.0	11,565.5	12,358.3	11,799.9	10,953.9	11,421.2	13,519.1	17,194.9	19,061.4	20,310.5	20,736.9	22,454.6	25,153.5	27,613.3
45-49	10,096.0	11,071.6	11,414.7	12,207.7	11,673.8	10,853.7	11,320.5	13,389.3	17,008.8	18,847.8	20,076.8	20,496.2	22,185.8	24,840.5
50-54	8,815.0	9,821.5	10,776.5	11,132.1	11,921.8	11,420.3	10,635.4	11,098.5	13,119.7	16,648.5	18,440.6	19,637.6	20,046.0	21,691.7
55-59	7,854.0	8,403.0	9,379.5	10,320.5	10,688.0	11,467.6	11,006.0	10,266.2	10,718.8	12,665.3	16,055.1	17,776.9	18,926.4	19,318.6
60-64	6,694.0	7,267.8	7,806.8	8,750.7	9,665.7	10,042.7	10,801.9	10,389.0	9,705.9	10,137.7	11,971.3	15,161.4	16,782.5	17,864.1
65-69	5,349.0	5,903.9	6,443.7	6,965.2	7,854.6	8,728.1	9,116.3	9,846.8	9,500.7	8,891.9	9,286.1	10,959.1	13,867.8	15,346.9
70-74	4,067.0	4,429.1	4,932.4	5,435.0	5,926.0	6,734.2	7,534.8	7,912.5	8,578.2	8,292.4	7,762.0	8,102.8	9,557.7	12,085.5
75-79	2,546.0	3,054.7	3,371.4	3,804.8	4,238.6	4,660.8	5,330.6	5,993.6	6,312.3	6,852.0	6,622.1	6,196.5	6,465.7	7,623.9
80-84	1,325.0	1,605.4	1,957.4	2,191.7	2,508.0	2,826.7	3,136.6	3,611.9	4,080.9	4,307.0	4,675.1	4,515.9	4,223.9	4,405.4
85+	782.0	891.1	1,091.0	1,362.4	1,600.3	1,874.4	2,163.0	2,450.4	2,824.1	3,219.5	3,481.1	3,773.0	3,785.0	3,627.3
TOTALS	166,073.0	180,409.8	194,498.1	209,842.8	227,436.7	247,010.0	267,270.8	287,894.3	308,970.5	330,802.7	352,986.9	375,194.1	398,156.5	421,745.9

TABLE 86

ESTIMATED AND PROJECTED MALE POPULATION OF THE UNITED STATES, BY AGE GROUP 1955 TO 2020

Median Projection

(In thousands of persons)

Age group:	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
0- 4	9,761.0	10,429.7	10,650.9	11,562.8	12,998.8	14,309.1	14,982.9	15,522.0	16,137.1	16,931.2	17,518.0	17,929.0	18,734.8	19,577.7
5- 9	8,765.0	9,740.4	10,404.9	10,627.7	11,537.9	12,970.2	14,277.2	14,949.8	15,488.1	16,101.3	16,892.7	17,477.4	17,886.9	18,689.8
10-14	6,787.0	8,761.9	9,732.9	10,396.9	10,620.2	11,529.1	12,959.0	14,263.7	14,935.5	15,472.9	16,084.8	16,874.5	17,457.9	17,866.6
15-19	5,684.0	6,782.6	8,746.3	9,714.9	10,377.8	10,601.5	11,508.1	12,933.5	14,234.0	14,903.6	15,439.0	16,043.7	16,835.5	17,416.7
20-24	5,404.0	5,684.2	6,766.9	8,715.5	9,678.9	10,340.0	10,565.7	11,469.3	12,887.9	14,181.5	14,847.0	15,378.9	15,984.5	16,766.0
25-29	5,811.0	5,423.2	5,691.7	6,766.0	8,699.6	9,657.6	10,316.3	10,543.0	11,442.0	12,850.9	14,134.9	14,795.4	15,323.2	15,924.2
30-34	6,075.0	5,831.7	5,439.9	5,708.7	6,776.6	8,697.3	9,650.0	10,305.2	10,531.2	11,424.3	12,823.2	14,098.0	14,753.8	15,277.8
35-39	5,690.0	6,073.7	5,828.7	5,445.1	5,714.4	6,774.9	8,680.7	9,262.7	10,277.4	10,501.9	11,387.4	12,774.4	14,038.4	14,688.5
40-44	5,501.0	5,657.4	6,032.8	5,798.2	5,425.2	5,694.2	6,743.0	8,625.7	9,561.0	10,203.9	10,425.5	11,299.5	12,668.6	13,916.3
45-49	4,991.0	5,404.2	5,558.6	5,934.0	5,713.3	5,355.2	5,623.0	6,652.9	8,498.8	9,416.2	10,046.0	10,263.0	11,118.9	12,459.7
50-54	4,351.0	4,806.8	5,207.9	5,369.0	5,741.5	5,540.5	5,204.4	5,469.4	6,469.1	8,255.8	9,142.9	9,751.6	9,961.3	10,788.5
55-59	3,847.0	4,075.3	4,511.4	4,903.6	5,071.4	5,437.4	5,261.2	4,953.7	5,211.6	6,162.9	7,857.2	8,698.2	9,275.2	9,473.9
60-64	3,258.0	3,462.5	3,682.2	4,095.2	4,471.7	4,645.2	4,998.9	4,853.5	4,581.9	4,825.3	5,703.0	7,264.7	8,039.8	8,571.7
65-69	2,582.0	2,760.6	2,944.5	3,151.3	3,530.1	3,884.4	4,066.0	4,404.1	4,298.5	4,070.6	4,287.7	5,064.7	6,447.2	7,133.4
70-74	1,888.0	2,034.2	2,190.2	2,358.0	2,549.0	2,883.7	3,202.5	3,379.1	3,681.6	3,605.7	3,416.6	3,598.2	4,248.4	5,405.2
75-79	1,150.0	1,335.1	1,455.8	1,586.6	1,727.8	1,887.2	2,154.0	2,409.3	2,555.2	2,791.3	2,734.8	2,591.7	2,729.2	3,221.3
80-84	582.0	679.7	800.4	885.3	977.9	1,078.0	1,189.9	1,369.6	1,541.1	1,639.6	1,791.7	1,755.5	1,663.7	1,751.9
85+	326.0	361.4	428.1	516.8	596.4	677.7	763.1	855.2	983.0	1,116.3	1,211.2	1,320.7	1,337.9	1,296.1
TOTALS	82,453.0	89,304.6	96,074.1	103,535.6	112,208.5	121,963.2	132,145.9	142,585.7	153,315.0	164,455.2	175,743.6	186,984.1	198,505.2	210,225.3

TABLE 87

ESTIMATED AND PROJECTED FEMALE POPULATION OF THE UNITED STATES, BY AGE GROUP 1955 TO 2020

Median Projection

(In thousands of persons)

Age group	1955*	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
0- 4	9,347.0	9,965.5	10,169.0	11,032.7	12,396.6	13,641.0	14,279.1	14,790.2	15,374.7	16,130.4	16,698.9	17,080.9	17,848.6	18,651.6
5- 9	8,386.0	9,336.7	9,951.5	10,156.4	11,019.0	12,380.4	13,622.6	14,260.0	14,770.5	15,353.9	16,107.5	16,664.8	17,055.3	17,820.9
10-14	6,556.0	8,395.5	9,341.9	9,956.5	10,161.8	11,023.8	12,384.0	13,624.8	14,261.8	14,771.7	15,354.4	16,107.0	16,663.6	17,053.5
15-19	5,507.0	6,588.2	8,417.7	9,363.1	9,977.3	10,183.0	11,044.0	12,402.2	13,641.1	14,277.2	14,786.2	15,367.9	16,119.2	16,674.8
20-24	5,371.0	5,581.6	6,647.2	8,472.3	9,416.1	10,029.8	10,235.9	11,095.3	12,450.8	13,686.8	14,321.3	14,829.1	15,409.3	16,158.7
25-29	5,941.0	5,461.4	5,656.5	6,719.5	8,539.7	9,481.7	10,094.8	10,301.4	11,158.8	12,510.6	13,743.1	14,375.8	14,882.0	15,460.5
30-34	6,325.0	5,997.2	5,509.5	5,705.6	6,765.4	8,579.7	9,519.5	10,131.6	10,338.5	11,193.1	12,540.0	13,767.9	14,398.3	14,902.7
35-39	5,918.0	6,343.6	6,012.1	5,530.6	5,727.8	6,783.4	8,589.5	9,526.1	10,136.4	10,342.8	11,193.2	12,533.1	13,754.8	14,381.9
40-44	5,716.0	5,908.2	6,325.8	6,002.2	5,528.9	5,727.2	6,776.3	8,569.7	9,500.7	10,107.2	10,312.1	11,155.8	12,485.3	13,697.4
45-49	5,105.0	5,667.4	5,856.3	6,274.0	5,960.9	5,498.7	5,697.8	6,736.7	8,510.6	9,431.9	10,031.4	10,233.8	11,067.6	12,381.3
50-54	4,464.0	5,014.7	5,568.8	5,763.5	6,180.7	5,080.4	5,431.4	5,629.5	6,651.0	8,393.4	9,298.1	9,886.7	10,085.4	10,904.1
55-59	4,007.0	4,327.7	4,868.3	5,417.3	5,617.1	6,030.9	5,745.6	5,313.0	5,507.8	6,502.9	8,198.8	9,079.3	9,652.1	9,845.5
60-64	3,436.0	3,805.5	4,124.7	4,655.8	5,194.5	5,398.0	5,803.7	5,536.4	5,124.6	5,313.1	6,269.0	7,897.7	8,743.2	9,293.3
65-69	2,767.0	3,143.4	3,499.4	3,813.9	4,324.8	4,844.0	5,050.7	5,443.3	5,202.9	4,821.8	4,999.0	5,894.9	7,421.4	8,213.8
70-74	2,179.0	2,394.9	2,742.3	3,077.2	3,377.0	3,850.8	4,332.6	4,533.7	4,897.2	4,687.4	4,345.8	4,505.0	5,309.8	6,681.0
75-79	1,396.0	1,719.5	1,915.7	2,218.3	2,510.9	2,773.6	3,176.8	3,584.6	3,757.5	4,061.2	3,887.9	3,605.2	3,737.0	4,403.1
80-84	743.0	925.8	1,157.0	1,306.4	1,530.2	1,748.7	1,946.7	2,242.4	2,540.0	2,667.7	2,883.8	2,760.9	2,560.4	2,653.8
85+	456.0	529.8	663.1	845.6	1,003.8	1,196.7	1,400.0	1,595.2	1,841.3	2,103.4	2,270.2	2,452.7	2,447.6	2,331.5
TOTALS	83,620.0	91,106.6	98,426.8	106,310.9	115,232.5	125,051.8	135,131.0	145,316.1	155,666.2	166,356.5	177,240.7	188,198.5	199,640.9	211,509.4

*Source:United States Bureau of the Census "Current Population Reports", Series P-25 No. 146, (0-5) group adjusted for net census undercount.

ATTACHMENT NO. 7

DETAILED COHORT-SURVIVAL PROJECTION OF CALIFORNIA POPULATION

TABLE 88

ESTIMATED AND PROJECTED TOTAL POPULATION OF CALIFORNIA, BY AGE GROUP 1955 TO 2020

High Projection

(In thousands of persons)

Age group	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
0- 4	1,406.0	1,755.4	2,126.6	2,606.2	3,078.7	3,489.3	3,901.4	4,346.4	4,800.5	5,234.8	5,623.3	5,976.0	6,303.4	6,593.8
5- 9	1,274.0	1,506.0	1,849.5	2,215.0	2,688.5	3,155.2	3,560.0	3,966.4	4,405.6	4,853.7	5,282.0	5,664.7	6,011.4	6,333.2
10-14	964.0	1,402.1	1,627.9	1,965.1	2,324.3	2,791.3	3,251.6	3,650.0	4,040.1	4,482.8	4,924.4	5,346.2	5,722.4	6,062.8
15-19	813.0	1,127.8	1,557.2	1,775.1	2,104.2	2,455.1	2,913.7	3,365.4	3,755.6	4,147.3	4,571.5	5,004.5	5,417.9	5,785.6
20-24	776.0	1,018.8	1,322.5	1,740.4	1,948.1	2,266.6	2,607.1	3,054.6	3,495.4	3,874.9	4,255.6	4,668.6	5,090.3	5,492.6
25-29	925.0	994.3	1,225.8	1,518.0	1,923.8	2,120.8	2,428.1	2,757.3	3,192.9	3,621.9	3,989.6	4,358.4	4,759.4	5,169.1
30-34	1,052.0	1,111.1	1,171.7	1,393.6	1,675.9	2,071.2	2,259.0	2,556.4	2,875.6	3,300.5	3,718.7	4,076.0	4,434.3	4,824.7
35-39	963.0	1,191.7	1,244.1	1,298.2	1,512.4	1,786.6	2,172.9	2,353.3	2,642.3	2,952.9	3,368.3	3,777.1	4,125.4	4,474.7
40-44	901.0	1,067.7	1,288.9	1,336.3	1,385.4	1,592.8	1,859.3	2,236.8	2,410.6	2,691.5	2,993.8	3,399.6	3,799.0	4,138.5
45-49	785.0	986.1	1,145.6	1,359.0	1,402.1	1,447.0	1,647.0	1,905.4	2,272.7	2,439.4	2,711.1	3,003.8	3,398.5	3,786.8
50-54	679.0	848.8	1,040.4	1,192.5	1,397.3	1,437.0	1,478.2	1,670.1	1,918.8	2,273.1	2,431.4	2,692.1	2,973.2	3,353.7
55-59	588.0	712.4	871.9	1,053.3	1,197.9	1,393.2	1,430.4	1,468.7	1,651.3	1,887.8	2,225.2	2,374.2	2,621.6	2,888.6
60-64	497.0	602.9	716.6	864.4	1,033.6	1,169.3	1,352.5	1,387.6	1,423.0	1,593.1	1,813.2	2,128.0	2,265.6	2,495.7
65+	1,079.0	1,316.4	1,571.3	1,854.9	2,195.9	2,602.1	3,026.7	3,512.4	3,906.9	4,230.2	4,617.1	5,094.9	5,725.5	6,306.2
TOTALS, Civilian	12,702.0	15,641.5	18,760.0	22,172.0	25,868.1	29,777.5	33,887.9	38,230.8	42,801.3	47,583.9	52,525.2	57,564.1	62,647.9	67,706.0
Military	336.0	340.0	300.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0
TOTALS	13,038.0	15,981.5	19,060.0	22,422.0	26,118.1	30,027.5	34,137.9	38,480.8	43,051.3	47,833.9	52,775.2	57,814.1	62,897.9	67,956.0

TABLE 89

ESTIMATED AND PROJECTED TOTAL POPULATION OF CALIFORNIA, BY AGE GROUP 1955 TO 2020

Median Projection

(In thousands of persons)

Age group	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
0- 4	1,406.0	1,702.4	1,986.9	2,339.1	2,718.4	3,064.7	3,339.3	3,604.4	3,875.3	4,136.0	4,343.7	4,499.2	4,765.8	5,043.9
5- 9	1,274.0	1,500.3	1,794.4	2,071.8	2,413.1	2,784.4	3,124.0	3,392.8	3,653.7	3,918.6	4,172.8	4,374.6	4,523.7	4,783.7
10-14	964.0	1,395.0	1,619.3	1,905.1	2,169.9	2,502.1	2,865.6	3,198.3	3,462.3	3,716.4	3,973.6	4,220.9	4,415.2	4,556.8
15-19	813.0	1,118.6	1,546.5	1,760.1	2,029.7	2,282.9	2,605.0	2,959.5	3,285.7	3,540.9	3,785.1	4,033.3	4,270.9	4,455.3
20-24	776.0	1,007.2	1,308.7	1,721.6	1,914.8	2,169.5	2,410.2	2,720.8	3,067.1	3,381.6	3,624.2	3,856.8	4,092.3	4,317.2
25-29	925.0	982.2	1,209.4	1,495.6	1,885.5	2,063.2	2,304.6	2,533.3	2,835.2	3,168.8	3,469.4	3,699.6	3,918.8	4,140.7
30-34	1,052.0	1,100.5	1,155.5	1,369.9	1,636.7	2,012.0	2,178.5	2,409.2	2,630.7	2,921.5	3,242.7	3,532.1	3,750.6	3,957.9
35-39	963.0	1,183.5	1,230.4	1,276.5	1,475.8	1,731.3	2,096.0	2,254.4	2,478.9	2,691.6	2,972.2	3,283.8	3,563.1	3,771.8
40-44	901.0	1,061.3	1,278.2	1,318.2	1,353.6	1,543.5	1,790.3	2,145.9	2,299.0	2,515.6	2,719.6	2,991.4	3,293.3	3,563.2
45-49	785.0	980.4	1,137.0	1,344.4	1,375.2	1,404.2	1,585.9	1,824.2	2,171.1	2,316.9	2,524.3	2,719.7	2,981.4	3,272.6
50-54	679.0	843.9	1,032.8	1,180.6	1,375.2	1,400.9	1,425.5	1,599.1	1,829.0	2,163.0	2,300.1	2,497.6	2,682.9	2,932.8
55-59	588.0	708.7	865.8	1,043.5	1,180.6	1,364.4	1,387.4	1,409.4	1,575.0	1,793.2	2,110.3	2,238.6	2,424.6	2,598.8
60-64	497.0	599.5	712.0	856.4	1,019.3	1,146.5	1,318.1	1,339.4	1,360.1	1,514.0	1,716.2	2,011.6	2,129.0	2,300.7
65+	1,079.0	1,309.7	1,560.9	1,838.7	2,166.6	2,555.0	2,957.3	3,415.3	3,778.1	4,063.8	4,407.1	4,836.1	5,412.0	5,933.0
TOTALS, Civilian	12,702.0	15,493.2	18,437.8	21,521.5	24,714.4	28,024.6	31,387.7	34,806.0	38,301.2	41,841.9	45,361.3	48,795.3	52,223.6	55,628.4
Military	336.0	340.0	300.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0
TOTALS	13,038.0	15,833.2	18,737.8	21,771.5	24,964.4	28,274.6	31,637.7	35,056.0	38,551.2	42,091.9	45,611.3	49,045.3	52,473.6	55,878.4

TABLE 90

ESTIMATED AND PROJECTED TOTAL POPULATION OF CALIFORNIA, BY AGE GROUP 1955 TO 2020

Low Projection

(In thousands of persons)

Age group	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
0- 4	1,406.0	1,637.2	1,831.1	2,079.3	2,304.1	2,452.8	2,529.7	2,753.7	2,956.0	3,129.7	3,263.4	3,386.4	3,518.0	3,653.6
5- 9	1,274.0	1,493.3	1,721.4	1,910.2	2,150.1	2,367.0	2,507.2	2,576.6	2,792.4	2,986.0	3,151.6	3,277.4	3,391.8	3,515.4
10-14	964.0	1,386.4	1,602.4	1,824.2	2,003.5	2,233.8	2,440.3	2,571.1	2,631.0	2,836.5	3,020.3	3,176.3	3,291.8	3,396.7
15-19	813.0	1,107.6	1,525.0	1,733.1	1,942.5	2,109.6	2,326.5	2,520.7	2,639.3	2,686.2	2,879.2	3,050.6	3,193.3	3,296.6
20-24	776.0	993.3	1,281.5	1,687.5	1,879.7	2,073.5	2,223.9	2,425.2	2,603.8	2,705.8	2,737.5	2,914.6	3,069.0	3,196.1
25-29	925.0	967.4	1,178.4	1,455.1	1,842.9	2,018.5	2,194.4	2,328.4	2,512.8	2,673.6	2,759.1	2,774.6	2,933.5	3,071.3
30-34	1,052.0	1,087.9	1,126.0	1,327.5	1,589.1	1,961.2	2,121.4	2,282.7	2,402.4	2,571.2	2,717.4	2,788.6	2,789.2	2,933.6
35-39	963.0	1,173.7	1,206.4	1,238.2	1,428.0	1,677.3	2,035.8	2,184.5	2,334.3	2,441.8	2,598.9	2,733.4	2,792.6	2,782.5
40-44	901.0	1,053.5	1,259.4	1,287.4	1,311.2	1,491.0	1,729.1	2,075.9	2,214.9	2,354.2	2,452.3	2,599.3	2,723.2	2,773.4
45-49	785.0	973.5	1,121.3	1,319.6	1,341.0	1,358.0	1,527.5	1,754.8	2,089.0	2,218.1	2,347.6	2,436.7	2,573.1	2,687.5
50-54	679.0	837.9	1,019.2	1,159.9	1,347.6	1,363.7	1,374.6	1,534.3	1,749.9	2,069.0	2,188.3	2,308.0	2,387.7	2,514.0
55-59	588.0	704.1	854.7	1,026.4	1,158.1	1,335.1	1,347.2	1,354.6	1,504.2	1,706.6	2,008.3	2,118.0	2,227.6	2,299.3
60-64	497.0	595.6	703.0	842.5	1,000.9	1,122.8	1,286.6	1,296.5	1,301.0	1,438.0	1,624.3	1,904.0	2,002.5	2,101.3
65•	1,079.0	1,301.8	1,542.5	1,810.6	2,129.6	2,506.5	2,892.8	3,329.1	3,660.6	3,905.1	4,200.8	4,578.1	5,099.1	5,560.7
TOTALS Civilian	12,702.0	15,313.2	17,972.3	20,701.5	23,428.3	26,070.8	28,537.0	30,988.1	33,391.6	35,721.8	37,949.0	40,046.0	41,992.4	43,782.0
Military	336.0	340.0	300.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0
TOTALS	13,038.0	15,653.2	18,272.3	20,951.5	23,678.3	26,320.8	28,787.0	31,238.1	33,641.6	35,971.8	38,199.0	40,296.0	42,242.4	44,032.0

ATTACHMENT NO. 8

TABLE OF HIGH AND LOW PROJECTIONS OF THE REGIONAL DISTRIBUTION OF CALIFORNIA'S POPULATION

TABLE 91

PROJECTED REGIONAL DISTRIBUTION OF POPULATION OF CALIFORNIA

Year	California		I 9 Southern California Counties			II 9 Bay Area Counties			III 15 Northeastern Counties			IV 3 Central Coastal Counties		
	Total population	10 year increase, per cent	Population	Per cent of California	10 year increase, per cent	Population	Per cent of California	10 year increase, per cent	Population	Per cent of California	10 year increase, per cent	Population	Per cent of California	10 year increase, per cent
	High Projection													
1960	15,950,000		9,450,000	59.25		3,745,000	23.48		400,000	2.51		300,000	1.88	
		39.2			39.7			35.1			45.0			43.3
1970	22,200,000		13,200,000	59.46		5,060,000	22.79		580,000	2.61		430,000	1.94	
		35.1			32.7			28.1			51.7			44.2
1980	30,000,000		17,520,000	58.40		6,480,000	21.60		880,000	2.93		620,000	2.07	
		28.3			23.3			23.5			50.0			46.8
1990	38,500,000		21,600,000	56.10		8,000,000	20.78		1,320,000	3.43		910,000	2.36	
		24.7			17.6			22.5			48.5			40.1
2000	48,000,000		25,400,000	52.92		9,800,000	20.42		1,960,000	4.08		1,275,000	2.66	
		20.8			13.0			20.4			35.2			34.1
2010	58,000,000		28,700,000	49.48		11,800,000	20.34		2,650,000	4.57		1,710,000	2.95	
		17.2			11.5			15.2			28.3			18.7
2020	68,000,000		32,000,000	47.06		13,600,000	20.00		3,400,000	5.00		2,030,000	2.98	
	Low Projection													
1960	15,650,000		9,310,000	59.49		3,672,000	23.46		388,000	2.48		290,000	1.85	
		32.9			35.4			29.7			27.6			34.5
1970	20,800,000		12,610,000	60.62		4,761,000	22.89		495,000	2.38		390,000	1.87	
		26.9			26.9			25.5			31.3			30.8
1980	26.400,000		16,000,000	60.61		5,975,000	22.63		650,000	2.46		510,000	1.93	
		18.9			16.7			18.8			33.8			29.4
1990	31,400,000		18,650,000	59.39		7,100,000	22.61		870,000	2.77		660,000	2.10	
		14.6			12.1			12.7			31.0			25.8
2000	36,000,000		20,900,000	58.06		8,000,000	22.22		1,140,000	3.17		830,000	2.31	
		11.1			9.8			9.4			16.7			16.9
2010	40,000,000		22,950,000	57.38		8,750,000	21.88		1,330,000	3.33		970,000	2.43	
		10.0			8.9			8.6			12.8			13.4
2020	44,000,000		25,000,000	56.8		9,500,000	21.59		1,500,000	3.41		1,100,000	2.50	

PROJECTED REGIONAL DISTRIBUTION OF POPULATION OF CALIFORNIA
(continued)

Year	V 8 San Joaquin Valley Counties Population	 Per cent of California	 10 year increase, per cent	VI Imperial County Population	 Per cent of California	 10 year increase, per cent	VII 3 North Coastal Counties Population	 Per cent of California	 10 year increase, per cent	VIII 10 Mountain Counties Population	 Per cent of California	 10 year increase, per cent
					High Projection							
1960	1,634,000	10.24		74,500	0.467		184,000	1.15		163,000	1.02	
			42.0			36.9			52.2			41.1
1970	2,320,000	10.45		102,000	0.460		280,000	1.26		230,000	1.04	
			55.2			29.4			50.0			52.2
1980	3,600,000	12.00		132,000	0.440		420,000	1.40		350,000	1.17	
			49.7			25.0			46.4			42.9
1990	5,390,000	14.00		165,000	0.429		615,000	1.60		500,000	1.30	
			44.7			21.2			42.3			38.0
2000	7,800,000	16.25		200,000	0.417		875,000	1.82		690,000	1.44	
			38.5			20.0			33.1			35.5
2010	10,800,000	18.62		240,000	0.414		1,165,000	2.01		935,000	1.61	
			29.6			16.7			25.3			31.6
2020	14,000,000	20.59		280,000	0.412		1,460,000	2.15		1,230,000	1.81	
					Low Projection							
1960	1,600,000	10.22		72,000	0.460		173,000	1.11		145,000	0.93	
			27.8			24.3			35.8			20.7
1970	2,045,000	9.83		89,500	0.430		235,000	1.13		175,000	0.84	
			27.6			22.7			34.0			31.4
1980	2,610,000	9.89		109,800	0.416		315,000	1.19		230,000	0.87	
			24.5			14.8			31.7			43.5
1990	3,250,000	10.35		126,000	0.401		415,000	1.32		330,000	1.05	
			22.2			11.1			31.3			36.4
2000	3,970,000	11.03		140,000	0.389		545,000	1.51		450,000	1.25	
			14.6			7.1			28.4			33.3
2010	4,550,000	11.38		150,000	0.375		700,000	1.75		600,000	1.50	
			12.5			6.7			21.4			28.3
2020	5,120,000	11.64		160,000	0.364		850,000	1.93		770,000	1.75	

ATTACHMENT NO. 9

TABLES OF COUNTY POPULATION PROJECTIONS

TABLE 92

HISTORICAL AND PROJECTED DISTRIBUTION OF POPULATION IN THE NINE SOUTHERN CALIFORNIA COUNTIES[a]

(Population in thousands)

Year	Nine Southern California Counties			Los Angeles County					
	Total population	Per cent of California	10-year increase: per cent	Coastal segment	Antelope Valley segment	Total County	Per cent of California	Per cent of Nine Southern California Counties	10-year increase per cent
Historical Population[b]									
1900	337	22.71				170	11.47	50.48	
1910	795	33.43	135.6			504	21.20	63.43	196.0
1920	1,380	40.28	73.7			936	27.33	67.84	85.8
1930	2,984	52.56	116.2			2,208	38.90	74.01	135.8
1940	3,781	54.74	26.7	2,778	8	2,786	40.33	73.67	26.1
1950	5,869	55.44	55.2	4,136	16	4,152	39.22	70.74	49.0
1958	8,706	59.58		5,728	64	5,792	39.64	66.53	
Projected Population									
1960	9,380	59.25	59.8	6,115	70	6,185	39.07	65.94	49.0
1970	13,100	60.37	39.7	7,898	180	8,078	37.23	61.66	30.6
1980	16,838	59.71	28.5	9,270	430	9,700	34.40	57.61	20.1
1990	19,920	56.91	18.3	9,632	678	10,310	29.46	51.76	6.3
2000	23,080	54.95	15.9	9,808	852	10,660	25.38	46.19	3.4
2010	25.955	52.97	12.5	9,908	972	10,880	22.20	41.92	2.1
2020	28,550	50.98	10.0	10,015	1,085	11,100	19.82	38.88	2.0

HISTORICAL AND PROJECTED DISTRIBUTION OF POPULATION IN THE NINE SOUTHERN CALIFORNIA COUNTIES[a]

(continued)

(Population in thousands)

Year	Orange County				San Bernardino County					
	Total population	Per cent of California	Per cent of Nine Southern California Counties	10-year increase per cent	Coastal segment	Mojave segment	Total County	Per cent of California	Per cent of Nine Southern California Counties	10-year increase per cent
					Historical Population[b]					
1900	20	1.33	5.84				28	1.88	8.28	
1910	34	1.45	4.33	74.8			57	2.39	7.13	103.0
1920	61	1.79	4.45	78.2			73	2.14	5.32	29.4
1930	119	2.09	3.98	93.4			134	2.36	4.49	82.4
1940	131	1.89	3.46	10.2	153	8	161	2.33	4.26	20.3
1950	216	2.04	3.68	65.4	258	24	282	2.66	4.80	74.8
1958	597	4.05	6.86		421	49	470	3.19	5.40	
					Projected Population					
1960	692	4.37	7.38	220.0	449	64	513	3.24	5.47	82.1
1970	1,320	6.08	10.08	90.8	695	135	830	3.82	6.34	61.8
1980	1,900	6.74	11.28	43.9	1,029	281	1,310	4.65	7.78	57.8
1990	2,320	6.63	11.65	22.1	1,482	493	1,975	5.64	9.91	50.8
2000	2,620	6.24	11.35	12.9	1,894	716	2,610	6.21	11.31	32.2
2010	2,800	5.71	10.79	6.9	2,270	880	3,150	6.43	12.14	20.7
2020	2,950	5.27	10.33	5.4	2,580	970	3,550	6.34	12.43	12.7

HISTORICAL AND PROJECTED DISTRIBUTION OF POPULATION IN THE NINE SOUTHERN CALIFORNIA COUNTIES[a]
(continued)

(Population in thousands)

Year	Riverside County						Ventura County			
	Coastal segment	Balance of County	Total County	Per cent of California	Per cent of Nine Southern California Counties	10-year increase per cent	Total County	Per cent of California	Per cent of Nine Southern California Counties	10-year increase per cent
					Historical Population[b]					
1900			18	1.21	5.31		14	0.97	4.26	
1910			35	1.46	4.37	93.9	18	0.77	2.31	27.7
1920			50	1.47	3.64	45.0	29	0.84	2.08	56.6
1930	64	17	81	1.43	2.72	61.1	55	0.97	1.84	91.4
1940	82	23	105	1.53	2.79	30.2	70	1.01	1.84	26.8
1950	123	47	170	1.61	2.90	61.2	115	1.08	1.95	64.6
1958	182	76	258	1.75	2.97		175	1.19	2.01	
					Projected Population					
1960	200	79	279	1.76	3.00	64.1	182	1.15	1.94	58.7
1970	322	121	443	2.04	3.38	58.8	288	1.33	2.20	58.2
1980	525	185	710	2.52	4.22	60.3	425	1.51	2.52	47.6
1990	840	280	1,120	3.20	5.62	57.7	635	1.81	3.19	49.4
2000	1,275	405	1,680	4.00	7.28	50.0	1,000	2.38	4.33	57.5
2010	1,730	530	2,260	4.61	8.71	34.5	1,350	2.76	5.20	35.0
2020	2,080	620	2,700	4.82	9.46	19.5	1,700	3.04	5.95	25.9

THE NINE SOUTHERN CALIFORNIA COUNTIES[a]
(continued)

(Population in thousands)

Year	San Diego County: Coastal segment	San Diego County: Balance of County	San Diego County: Total County	San Diego County: Per cent of California	San Diego County: Per cent of Nine Southern California Counties	San Diego County: 10-year increase per cent	San Luis Obispo County: Total County	San Luis Obispo County: Per cent of California	San Luis Obispo County: Per cent of Nine Southern California Counties	San Luis Obispo County: 10-year increase per cent
					Historical Population[b]					
1900			35	2.36	10.40		17	1.12	4.93	
1910			62	2.59	7.76	75.7	19	0.82	2.44	16.5
1920			112	3.28	8.15	82.0	22	0.64	1.59	12.9
1930	209	1	210	3.69	7.03	86.8	30	0.52	0.99	35.3
1940	288	1	289	4.19	7.65	38.0	33	0.48	0.88	12.3
1950	555	2	557	5.26	9.49	92.4	51	0.49	0.88	54.6
1958	941	2	943	6.40	10.84		67	0.45	0.76	
					Projected Population					
1960	1,018	2	1,020	6.44	10.85	83.2	70	0.44	0.75	36.2
1970	1,452	3	1,455	6.71	11.11	42.6	92	0.42	0.70	31.4
1980	1,895	5	1,900	6.74	11.28	30.6	130	0.46	0.77	41.3
1990	2,341	9	2,350	6.72	11.80	23.7	205	0.59	1.03	57.7
2000	2,784	16	2,800	6.67	12.13	19.1	340	0.81	1.47	65.8
2010	3,110	40	3,150	6.43	12.14	12.5	520	1.06	2.00	52.9
2020	3,396	59	3,455	6.17	12.10	9.7	700	1.25	2.45	34.6

HISTORICAL AND PROJECTED DISTRIBUTION OF POPULATION IN THE NINE SOUTHERN CALIFORNIA COUNTIES[a]

(continued)

(Population in thousands)

Year	Santa Barbara County: Total County	Santa Barbara County: Per cent of California	Santa Barbara County: Per cent of Nine Southern California Counties	Santa Barbara County: 10-year increase per cent	Kern County: Mojave segment	Kern County: San Joaquin segment	Kern County: Total County	Kern County: Per cent of California	Kern County: Per cent of Nine Southern California Counties	Kern County: 10-year increase per cent
Historical Population[b]										
1900	19	1.27	5.61				16	1.11	4.89	
1910	28	1.17	3.49	46.5			38	1.59	4.75	128.8
1920	41	1.20	2.98	48.2			55	1.60	3.97	45.4
1930	65	1.15	2.18	58.6			83	1.45	2.77	50.6
1940	71	1.02	1.87	8.3	6	129	135	1.96	3.57	63.6
1950	98	0.93	1.67	39.2	20	208	228	2.16	3.89	69.0
1958	124	0.84	1.42		38	241	279	1.89	3.21	
Projected Population										
1960	148	0.93	1.58	50.7	42	249	291	1.84	3.10	27.5
1970	207	0.95	1.58	39.9	60	325	385	1.77	2.94	32.3
1980	283	1.00	1.68	36.7	85	395	480	1.70	2.85	24.7
1990	385	1.10	1.93	36.0	117	503	620	1.77	3.11	29.2
2000	520	1.24	2.25	35.1	165	685	850	2.02	3.68	37.1
2010	695	1.42	2.68	33.6	228	922	1,150	2.35	4.43	35.3
2020	915	1.63	3.20	31.7	296	1,184	1,480	2.64	5.18	28.7

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a. Median projection.

b. Historical population rounded to nearest thousand with percentages based upon exact populations.

ATTACHMENT NO. 10

TABLES OF UNITED STATES, CALIFORNIA AND SOUTHERN CALIFORNIA AREA EMPLOYMENT

TABLE 93

HISTORICAL AND PROJECTED EMPLOYMENT IN THE UNITED STATES[a]

(Employment values in thousands)

Employment sectors	Historical employment						Projected employment			
	1940		1950		1956		1970		1980	
	Employment	Per cent of total employment	Employment	Per cent of total employment	Employment	Per cent of total employment	Employment	Per cent of total employment	Employment	Per cent of total employment
Industry Categories										
Agriculture	8,044	17.8	6,477	11.4	5,304	8.5	4,884	6.2	4,510	4.8
Mining	965	2.1	952	1.7	858	1.4	872	1.1	853	0.9
Construction	1,941	4.3	3,370	5.9	3,955	6.4	5,282	6.7	6,560	7.0
Manufacturing	11,009	24.3	15,154	26.6	17,120	27.5	22,559	28.6	26,454	28.2
Transportation	1,611	3.6	1,999	3.5	2,517	4.0	4,856	6.2	5,248	5.6
Trade	8,783	19.4	11,428	20.0	12,868	20.6	16,313	20.7	19,434	20.7
Finance	2,256	5.0	4,124	7.2	4,330	6.9	2,958	3.8	3,411	3.6
Services	6,707	14.8	7,808	13.7	9,019	14.5	11,009	13.9	14,452	15.4
Government	3,918	8.7	5,674	10.0	6,343	10.2	10,150	12.8	13,017	13.8
TOTALS	45,234	100.0	56,986	100.0	62,314	100.0	78,883	100.0	93,939	100.0
Manufacturing Categories										
Food-kindred	1,363	12.4	1,648	10.9	1,673	9.8	2,214	9.8	2,597	9.8
Textiles	1,226	11.1	1,296	8.6	1,068	6.2	1,022	4.5	960	3.6
Apparel	936	8.5	1,211	8.0	1,247	7.3	1,492	6.6	1,628	6.2
Lumber	511	4.6	826	5.4	753	4.4	1,013	4.5	1,178	4.5
Furniture	412	3.7	379	2.5	387	2.3	687	3.0	1,037	3.9
Paper	337	3.1	485	3.2	568	3.3	825	3.7	1,037	3.9
Printing	586	5.3	764	5.0	873	5.1	1,051	4.7	1,261	4.8
Chemicals	473	4.3	681	4.5	845	4.9	798	3.5	801	3.0
Petroleum	151	1.4	238	1.6	246	1.4	362	1.6	425	1.6
Rubber	156	1.4	245	1.6	273	1.6	368	1.6	427	1.6

HISTORICAL AND PROJECTED EMPLOYMENT IN THE UNITED STATES
(continued)

(Employment values in thousands)

Employment sectors	Historical employment						Projected employment			
	1940		1950		1956		1970		1980	
	Employment	Per cent of total employment	Employment	Per cent of total employment	Employment	Per cent of total employment	Employment	Per cent of total employment	Employment	Per cent of total employment
Leather	369	3.4	396	2.6	380	2.2	450	2.0	495	1.9
Stone, Clay and Glass	373	3.4	528	3.5	575	3.3	613	2.7	658	2.5
Primary metals	1,668[b]	15.2[b]	1,194	7.9	1,324	7.7	2,104	9.3	2,207	8.3
Fabricated metals	0[b]	0[b]	1,036	6.8	1,269	7.4	1,877	8.3	2,744	10.4
Precision Equipment (instruments)	0[b]	0[b]	248	1.6	336	2.0	580	2.6	662	2.5
Miscellaneous	348	3.2	469	3.1	515	3.0	768	3.4	812	3.1
Machinery	798	7.2	1,375	9.1	1,737	10.2	2,400	10.7	2,831	10.7
Electrical Machinery	456	4.1	876	5.8	1,211	7.1	1,798	8.0	2,306	8.7
Transportation Equipment	846	7.7	1,259	8.3	1,840	10.8	2,137	9.5	2,388	9.0
TOTALS	11,009	100.0	15,154	100.0	17,120	100.0	22,559	100.0	26,454	100.0

a. Includes wage and salary workers, employers, and own-account workers.
b. In 1940 employment was not segregated between these classes.

Note: Source of Historical Data: Table 28 in U. S. Department of Commerce, Office of Business Economics publications (1) "National Income, 1954 Edition" and (2) "Survey of Current Business, July 1957".

TABLE 94

HISTORICAL AND PROJECTED EMPLOYMENT IN CALIFORNIA

(Employment values in thousands)

Employment sectors	1940			1950			1956			1970			1980		
	Employment	Per cent of U. S. employment in California by sectors	Per cent of total employment by sectors	Employment	Per cent of U. S. employment in California by sectors	Per cent of total employment by sectors	Employment	Per cent of U. S. employment in California by sectors	Per cent of total employment by sectors	Employment[a]	Per cent of U. S. employment in California by sectors	Per cent of total employment by sectors	Employment[a]	Per cent of U. S. employment in California by sectors	Per cent of total employment by sectors
Industry categories															
Agriculture	317	3.9	11.7	424	6.6	10.1	490	9.2	8.9	532	10.9	6.4	546	12.1	4.9
Mining	46	4.8	1.7	35	3.7	.8	41	4.8	.7	45	5.2	.5	50	5.9	.4
Construction	128	6.6	4.7	289	8.6	6.9	372	9.4	6.8	590	11.2	7.1	830	12.6	7.4
Manufacturing	461	4.2	17.0	797	5.3	18.9	1,246	7.3	22.7	2,155	9.6	25.8	2,040	11.5	27.1
Transportation	197	12.2	7.3	314	15.7	7.5	371	14.7	6.8	539	11.1	6.4	682	13.0	6.1
Trade	659	7.5	24.5	974	8.5	23.2	1,194	9.3	21.7	1,778	10.9	21.3	2,334	12.0	20.8
Finance	124	5.5	4.6	174	4.2	4.1	232	5.4	4.2	328	11.1	3.9	416	12.2	3.7
Services	505	7.5	18.7	662	8.5	15.8	841	9.3	15.3	1,210	11.0	14.5	1,734	12.0	15.5
Government	266	6.8	9.8	533	9.4	12.7	707	11.1	12.9	1,180	11.6	14.1	1,580	12.1	14.1
TOTALS	2,703[a]		100.0	4,202[a]		100.0	5,494[a]		100.0	8,357		100.0	11,212		100.0
Manufacturing categories															
Food-kindred	91		22.0	133	8.1	17.4	148	8.8	12.4	259	11.7	12.0	357	13.7	11.7
Textiles	6	.5	1.4	8	.6	1.0	6	.6	.5	18	1.8	.8	26	2.7	.8
Apparel	26	2.8	6.3	49	4.0	6.4	60	4.8	5.0	103	6.9	4.8	137	8.4	4.5
Lumber	25	4.9	6.0	53	6.4	7.0	61	8.1	5.1	79	7.8	3.7	86	7.3	2.9
Furniture	18	4.4	4.3	22	5.8	2.9	30	7.8	2.5	74	10.8	3.4	121	11.7	4.0
Paper	6	1.8	1.4	12	2.5	1.6	24	4.2	2.0	61	7.4	2.8	101	9.7	3.3
Printing	30	5.1	7.2	48	6.3	6.3	61	7.0	5.1	120	11.4	5.6	144	11.4	4.7
Chemicals	16	3.4	4.0	30	4.4	4.0	39	4.6	3.3	64	8.0	3.0	86	10.7	2.9
Petroleum	18	11.9	4.3	32	13.4	4.2	35	14.2	3.0	49	13.5	2.3	55	12.9	1.8
Rubber	7	4.5	1.7	14	5.7	1.8	18	6.6	1.5	35	9.5	1.6	51	11.9	1.7
Leather	3	.8	.7	5	1.3	.6	7	1.8	.6	12	2.7	.6	17	3.4	.6
Stone, clay and glass	17	4.6	4.1	34	6.4	4.5	41	7.1	3.4	58	9.5	2.7	73	11.1	2.4
Primary metals	22	—	5.3	39	3.3	5.1	49	5.4	4.1	115	5.5	5.3	150	6.8	5.0

HISTORICAL AND PROJECTED EMPLOYMENT IN CALIFORNIA
(continued)

(Employment values in thousands)

Employment sectors	1940			1950			1956			1970			1980		
	Employment	Per cent of U. S. employment in California by sectors	Per cent of total employment by sectors	Employment	Per cent of U. S. employment in California by sectors	Per cent of total employment by sectors	Employment	Per cent of U. S. employment in California by sectors	Per cent of total employment by sectors	Employment[a]	Per cent of U. S. employment in California by sectors	Per cent of total employment by sectors	Employment[a]	Per cent of U. S. employment in California by sectors	Per cent of total employment by sectors
Manufacturing categories (continued)															
Fabricated metals	24	---	6.0	55	5.3	7.2	82	6.5	6.8	175	9.3	8.1	320	11.7	10.5
Precision equipment (instruments)	1	---	.0	7	2.8	1.0	17	5.0	1.4	48	8.3	2.2	72	10.9	2.4
Miscellaneous	13	3.7	3.1	26	5.5	3.4	42	8.2	3.5	88	11.4	4.1	114	14.0	3.7
Machinery	24	3.0	6.0	50	3.6	6.6	90	5.2	7.5	186	7.8	8.6	275	9.7	9.0
Electrical machinery	9	2.0	2.2	26	3.0	3.4	87	7.2	7.3	254	14.1	11.8	448	19.4	14.7
Transportation equipment	58	6.8	14.0	119	9.4	15.6	299	16.2	25.0	357	16.7	16.6	407	17.0	13.4
TOTALS	414[b]		100.0	762[b]		100.0	1,196[b]		100.0	2,155		100.0	3,040		100.0

a. Includes wage and salary workers, employers, own-account workers, and unpaid family workers.
b. Workers covered by the California Unemployment Insurance Code. These are less than total employment in manufacturing.

Note: Source of Data: (1) U.S. employment values from Table 93.
(2) California employment by industry categories from "Handbook of California Labor Statistics, 1955-1956" by State of California, Department of Industrial Relations, Division of Labor Statistics and Research.
(3) California employment by manufacturing categories from "California Employment and Payrolls", annual reports by State of California, Department of Employment.

TABLE 95

HISTORICAL AND PROJECTED EMPLOYMENT IN THE SOUTHERN CALIFORNIA REGION

(Employment values in thousands)

Employment sectors	1940			1950			1956			1970			1980		
	Southern California region employment	Per cent of California employment area by sectors	Per cent of total region employment by sectors	Southern California region employment	Per cent of California employment area by sectors	Per cent of total region employment by sectors	Southern California region employment	Per cent of California employment area by sectors	Per cent of total region employment by sectors	Southern California region employment	Per cent of California employment area by sectors	Per cent of total region employment by sectors	Southern California region employment	Per cent of California employment area by sectors	Per cent of total region employment by sectors
Industry categories															
Agriculture	110	34.7	7.4	131	30.9	6.0	142	29.0	4.4	114	21.4	2.3	98	17.9	1.5
Mining	28	60.7	1.9	26	74.3	1.2	31	75.6	1.0	28	62.2	.6	26	52.0	.4
Construction	71	55.5	4.8	135	46.7	6.3	224	60.2	6.7	360	61.0	7.2	481	58.0	7.2
Manufacturing	262	56.8	17.6	474	59.5	22.0	878	70.5	27.0	1,460	67.7	29.0	2,000	65.8	30.2
Transportation	98	49.7	6.6	133	42.4	6.2	196	52.8	6.0	307	57.0	6.0	382	56.0	5.7
Trade	371	56.3	25.0	460	47.2	21.4	713	59.7	21.8	1,118	62.9	22.2	1,437	61.6	21.6
Finance	67	54.0	4.5	84	48.3	3.9	135	58.2	4.0	208	63.4	4.1	256	61.5	3.8
Services	304	60.2	20.4	420	63.4	19.5	565	67.2	17.3	794	65.6	15.8	1,120	64.6	16.8
Government	176	66.2	11.8	291	54.6	13.5	378	53.5	11.6	643	54.5	12.8	853	54.0	12.8
TOTALS	1,487[a]		100.0	2,154[a]		100.0	3,262[a]		100.0	5,032		100.0	6,653		100.0
Manufacturing categories															
Food-kindred	38	41.8	16.8	53	39.8	11.6	58	39.2	7.1	96	37.1	6.6	130	36.4	6.5
Textiles	3	50.0	1.3	5	62.5	1.1	4	66.7	.5	12	66.7	.8	19	73.1	1.0
Apparel	20	76.9	8.8	41	83.7	8.9	48	80.0	5.9	83	80.6	5.7	111	81.0	5.5
Lumber	2	8.0	.9	7	13.2	1.5	8	13.1	1.0	13	16.4	.9	16	18.6	.8
Furniture	11	61.1	5.0	18	81.8	3.9	24	80.0	3.0	54	73.0	3.7	78	64.5	4.0
Paper	3	50.0	1.3	8	66.7	1.7	13	54.2	1.6	25	41.0	1.7	34	33.7	1.7
Printing	15	50.0	6.6	27	56.2	5.9	36	59.0	4.4	74	61.7	5.1	93	64.6	4.6
Chemicals	7	43.8	3.1	16	53.3	3.5	24	61.5	3.0	39	60.9	2.7	55	64.0	2.8
Petroleum	10	55.6	4.4	18	56.2	3.9	21	60.0	2.6	29	59.2	2.0	33	60.0	1.6
Rubber	6	85.7	2.6	12	85.7	2.6	16	88.9	2.0	29	82.8	2.0	40	78.4	2.0
Leather	2	66.7	.9	4	80.0	.9	5	71.4	.6	9	75.0	.6	13	76.5	.6
Stone, clay, and glass	11	64.7	5.0	23	67.6	5.0	27	65.8	3.3	36	62.1	2.5	43	58.9	2.2
Primary metals	10	45.4	4.4	26	66.7	5.6	35	71.4	4.3	73	63.5	5.0	90	60.0	4.5
Fabricated metals	15	62.5	6.6	35	63.6	7.6	59	72.0	7.2	119	68.0	8.2	208	65.0	10.4
Precision equipment (instruments)	--	--	--	7	100.0	1.5	15	88.2	1.8	43	89.6	2.9	65	90.3	3.2

HISTORICAL AND PROJECTED EMPLOYMENT IN THE SOUTHERN CALIFORNIA REGION
(continued)

(Employment values in thousands)

Employment sectors	1940			1950			1956			1970			1980		
	Southern California region employment	Per cent of California employment in area by sectors	Per cent of total region employment by sectors	Southern California region employment	Per cent of California employment in area by sectors	Per cent of total region employment by sectors	Southern California region employment	Per cent of California employment in area by sectors	Per cent of total region employment by sectors	Southern California region employment	Per cent of California employment in area by sectors	Per cent of total region employment by sectors	Southern California region employment	Per cent of California employment in area by sectors	Per cent of total region employment by sectors
Manufacturing categories (continued)															
Miscellaneous	--	--	--	--	--	--	--	--	--	75	85.2	5.1	91	79.8	4.6
Machinery	14	58.3	6.2	33	66.7	7.2	66	73.3	8.1	132	71.0	9.0	193	70.2	9.6
Electrical machinery	5	55.6	2.2	19	73.1	4.1	70	80.4	8.6	200	78.7	13.7	341	76.1	17.0
Transportation equipment	54	93.1	23.9	108	90.8	23.5	284	95.0	35.0	319	89.4	21.8	347	85.2	17.4
TOTALS	226[b]		100.0	460[b]		100.0	813[b]		100.0	1,460		100.0	2,000		100.0

a. Includes wage and salary workers, employers, own-account workers, and unpaid family workers.
b. Workers covered by the California Unemployment Insurance Code. These are less than total employment in manufacturing.

Note: Source of Data: (1) Employment by industry categories based on State of California, Departments of Employment and Industrial Welfare publications and unpublished estimates, and Department of Water Resources analyses of data on insured workers.
(2) Employment by manufacturing categories obtained from unpublished records of State of California, Department of Employment, and from its annual reports entitled "California Employment and Payrolls".

ATTACHMENT NO. 11

TABLE OF HISTORICAL AND PROJECTED MARKET DEMAND FOR AND PRODUCTION OF MAJOR SOUTHERN CALIFORNIA CROPS

HISTORICAL AND PROJECTED MARKET DEMAND FOR AND PRODUCTION OF MAJOR SOUTHERN CALIFORNIA CROPS

Crop	1950-1956			1960-1969			1970-1979			1980-1989			1990-1999			2000-2009			2010-2020		
	Market demand in: U. S. A. in millions of pounds	California production: In millions of pounds	California production: In per cent of U. S. demand	Market demand in: U. S. A. in millions of pounds	California production: In millions of pounds	California production: In per cent of U. S. demand	Market demand in: U. S. A. in millions of pounds	California production: In millions of pounds	California production: In per cent of U. S. demand	Market demand in: U. S. A. in millions of pounds	California production: In millions of pounds	California production: In per cent of U. S. demand	Market demand in: U. S. A. in millions of pounds	California production: In millions of pounds	California production: In per cent of U. S. demand	Market demand in: U. S. A. in millions of pounds	California production: In millions of pounds	California production: In per cent of U. S. demand	Market demand in: U. S. A. in millions of pounds	California production: In millions of pounds	California production: In per cent of U. S. demand
Avocados	71.9	49.2	68	143	93.9	66	220	144.3	66	318	208.7	66	451	295.6	66	580	382.8	66	745	491.5	66
Lemons	922	894	97	1,546	1,507	97	1,924	1,810	94	2,408	2,221	92	3,091	2,701	90	3,547	3,091	87	4,202	3,607	86
Navel Oranges	5,369	1,134	21	7,123	1,389	20	8,683	1,741	20	10,570	2,194	21	13,062	2,797	21	14,996	3,301	22	17,521	3,924	22
Valencia Oranges	5,082	1,838	36	6,536	1,370	21	8,110	1,764	22	9,981	2,275	23	12,521	2,955	24	14,505	3,512	24	17,243	4,281	25
Apples	4,442	411	9.2	5,382	489.2	9.1	6,644	556.7	8.4	8,028	634.1	7.9	9,852	734.1	7.4	11,414	790.2	6.9	13,478	872.1	6.5
Apricots	394	376	95	503	479.5	95	612	584.2	96	739	706.5	96	909	864.4	95	1,036	990.4	96	1,209	1,153.5	95
Olives	208	94	45	270	123.3	46	330	151.2	46	404	184.6	46	502	228.2	45	576	263.4	46	678	309.2	46
Peaches	2,477	1,534	62	3,072	2,074	68	3,574	2,474	69	4,121	2,997	73	4,862	3,623	75	5,338	4,144	78	5,986	4,717	79
Pears	975	703	72	1,194	919.8	77	1,443	1,099.7	76	1,713	1,338	78	2,098	1,652.6	79	2,388	1,896.5	79	2,775	2,219.8	80
Plums	165	155	94	207	196	94	250	234	94	300	276	92	366	334	91	414	376	91	480	428	89
Almonds (in shell)	93	92	99	127	117.2	92	161	143.4	89	203	180.5	89	256	227.8	89	298	265.1	89	343	305.2	89
Walnuts (in shell)	159	131	83	206	160	78	250	192	77	301	233	77	369	288	78	421	334	79	487	398	82
Raisin Grapes	3,036	3,036	100	--	3,836	--	--	4,696	--	--	5,700	--	--	6,928	--	--	7,726	--	--	8,760	--
Table Grapes	1,391	1,085	78	--	1,487	--	--	1,970	--	--	2,542	--	--	3,273	--	--	3,793	--	--	4,360	--
Wine Grapes	1,206	1,146	95	--	1,390	--	--	1,787	--	--	2,301	--	--	2,924	--	--	3,407	--	--	3,964	--
Alfalfa	101,185	9,976	10	142,860	14,062	9.8	170,679	17,608	10.3	203,644	20,962	10.3	246,931	23,731	9.6	278,150	25,969	9.3	320,666	27,667	8.6
Cotton, Lint	6,776	720	11	7,202	936	13.0	8,133	1,392	17	9,152	1,920	21	10,280	2,472	24	11,449	3,048	27	12,645	3,672	29
Dry Beans	1,215	406	33	998	333	33	894	309	35	937	308	33	985	318	32	983	316	32	1,031	337	33
Field Corn	180,254	349	0.2	223,098	1,373	0.6	265,756	1,872	0.7	322,458	2,439	0.8	392,483	3,026	0.8	444,268	3,664	0.8	513,336	4,310	0.8
Sugar Beets	24,770	6,839	28	31,736	9,092	29	37,572	10,768	29	44,154	12,631	29	52,755	15,127	29	59,002	16,622	29	66,992	19,106	29
Artichokes	32	32	100	39.1	39.1	100	45.8	45.8	100	53.5	53.5	100	63.6	63.6	100	70.2	70.2	100	79.3	79.3	100
Asparagus	262	168	64	337	219.2	65	412	261.2	63	508	310.4	61.0	632	375	59	727	421.4	58.0	856	483.6	57
Broccoli	201	120	60	296	200	68	401	273	68.0	527	364	69.0	693	466	70	832	597	72	1,007	741	74
Cantaloupes	1,438	639	44	1,800	822	46	2,131	985	46	2,542	1,204	47	3,083	1,462	47	3,442	1,651	48.0	3,924	1,942	50
Celery	1,374	735	54	1,849	1,076	58	2,314	1,397	60	2,877	1,779	62	3,623	2,304	64	4,267	2,739	64	5,074	3,330	66
Green Limas	400	61	15	522	78.3	15.0	619	105.4	17.0	733	139.1	19.0	880	184.3	21	987	221	22	1,126	269.5	24
Lettuce	3,100	1,803	58	4,403	2,524	57	5,659	3,253	58	7,011	4,148	59	8,771	5,339	61	10,079	6,322	63	11,733	7,690	66
Onions	1,758	336	19	2,074	430.5	21	2,383	526.9	22	2,729	642.2	24	3,210	826.3	26	3,477	948.2	27	3,845	1,109.9	29
Potatoes	16,539	2,573	16	18,592	3,072	17	20,848	3,551	17.0	23,549	4,121	18	26,695	4,862	18	28,096	5,338	19.0	30,523	5,986	20
Sweet Corn	3,648	130	3.6	4,853	225	4.6	5,728	310	5.4	6,770	407	6.0	8,040	518	6.4	9,061	631	7.0	10,346	756	7.3
Tomatoes	8,245	4,137	50	10,763	5,558	52	13,059	6,965	53	15,815	8,670	55	19,449	10,932	46	22,266	12,784	57	26,004	15,222	59
Watermelons	2,892	254	8.8	3,562	313	8.8	4,147	367	8.8	4,844	428	8.8	5,752	508	8.8	6,322	562	8.9	7,135	634	8.9

ATTACHMENT NO. 12

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS BY COUNTIES

TABLE 97

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN THE SAN LUIS OBISPO SERVICE AREA

Crop[a]	1 Production unit	2 Yield[b]	3 Average F.O.B. prices received: 1952-56	4 Gross income 4=2x3	5 Crop production costs[c]	6 Operator's labor and management	7 Residual income[d] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7÷8
Deciduous Fruits, Nuts, and Vines									
c Walnuts	ton	1.0	$517.00	$ 517	$ 325	$ 52	$140	.9	$155
i Walnuts	ton	1.0	517.00	517	325	52	140	1.6	88
Truck crops									
c Artichokes	crate	200	3.02	604	367	75	162	1.9	85
c String Beans	ton	9.0	125.30	1,128	913	58	157	1.9	83
c Cauliflower	crate	500	1.33	665	632	27	6	1.9	3
c Celery	crate	1,000	2.23	2,230	2,020	70	140	1.9	74
c Cucumbers	lug	700	1.50	1,050	620	73	357	1.9	188
c Lettuce	crate	350	2.11	739	630	46	63	1.9	33
c Bell Peppers	crate	250	3.54	885	584	61	240	1.9	126
i Strawberries	lb	26,000	.12	3,120	2,165	169	786	1.8	437
i Potatoes	cwt	250	2.55	638	542	51	45	2.3	20
Field Crops									
c Alfalfa Hay	ton	6.0	27.40	164	117	16	31	3.5	9
i Alfalfa Hay	ton	7.0	27.40	192	123	19	50	3.7	14

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN THE SAN LUIS OBISPO SERVICE AREA
(continued)

Crop[a]	1 Production unit	2 Yield[b]	3 Average: F.O.B. prices received: 1952-56	4 Gross income: 4=2x3	5 Crop production costs[c]	6 Operator's labor and management	7 Residual income[d] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7÷8
Field Crops (continued)									
c Irrigated Pasture	AUM[e]	11	$ 7.00	$ 77	$ 58	$ 8	$ 11	3.5	$ 3
i Irrigated Pasture	AUM[e]	12	7.00	84	58	8	18	3.9	5
i Sugar Beets	ton	25	14.80	370	262	42	66	1.9	35
c Sugar Beets	ton	25	14.80	370	262	42	66	1.1	60

Note: Columns 2 through 8 expressed as values per acre.

a. c = coastal areas.
 i = inland areas.

b. On better lands mostly of "V" and "H" classes.

c. All costs except irrigation water are included.

d. A maximum residual above all farm operating costs except irrigation water available to pay for water and as operator's incentive to farm.

e. AUM is an animal unit month equal to .4 ton of alfalfa hay.

TABLE 98

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN THE SANTA BARBARA SERVICE AREA

Crop[a]	1 Production unit	2 Yield[b]	3 Average: F.O.B. prices received: 1952-56	4 Gross income: 4=2x3	5 Crop production costs[c]	6 Operator's labor and management	7 Residual income[d] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7÷8
Citrus, Subtropical Fruit									
c Lemons	packed box	360	$ 4.44	$1,598	$1,178	$120	$300	1.6	$188
c Avocados	flat	346	2.11	730	476	67	187	1.6	117
Truck Crops									
i Potatoes	cwt	300	2.84	852	710	51	91	2.3	40
i,c Snap Beans	ton	3	178.00	534	420	37	77	2.3	33
i Artichokes	crate	200	2.50	500	335	95	70	2.3	30
i Carrots	crate	300	3.59	1,077	882	53	142	2.3	62
i Broccoli	ton	3	120.00	360	311	36	13	2.3	6
i Lettuce	crate	350	2.19	767	550	69	148	2.3	64
i Flower Seed	pound	300	1.30	390	241	64	85	1.4	61
i Cut Flowers	acre			2,950	2,330	395	225	1.5	150
i Cabbage	crate	300	2.27	681	384	115	182	2.3	79
i Celery	crate	1,000	2.08	1,080	1,870	70	140	2.3	61
Field Crops									
i Ensilage	ton	25	8.50	213	146	25	42	1.4	30
i Alfalfa Hay	ton	7	26.00	182	122	28	32	2.9	11
i Sugar Beets	ton	20	14.40	288	188	54	46	1.4	33

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN THE SANTA BARBARA SERVICE AREA

(continued)

Crop[a]	1 Produc-tion unit	2 Yield[b]	3 Average: F.O.B. prices received: 1952-56	4 Gross income 4=2x3	5 Crop produc-tion costs[c]	6 Operator's labor and management	7 Residual income[d] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7÷8
Field Crops (continued)									
c Irrigated Pasture	AUM[e]	12	$ 7.00	$ 84	$ 58	$ 8	$ 18	3.0	$ 6
i Irrigated Pasture	AUM[e]	12	7.00	84	52	8	24	3.1	8
Deciduous Friuts, Nuts, and Vines									
c Walnuts	ton	1	524.00	524	325	52	147	1.3	113
i Walnuts	ton	1	524.00	524	284	52	188	1.9	99

Note: Columns 2 through 8 expressed as values per acre.

a. c = coastal areas.
   i = inland areas.

b. On better lands mostly of "V" and "H" classes.

c. All costs except irrigation water are included.

d. A maximum residual above all farm operating costs available to pay for water and as operator's incentive to farm.

e. AUM is an animal unit month equal to .4 ton of alfalfa hay.

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN THE VENTURA COUNTY SERVICE AREA

Crop[a]	1 Production unit	2 Yield[b]	3 Average: F.O.B. prices received: 1952-56	4 Gross income 4=2x3	5 Crop production costs[c]	6 Operator's labor and management	7 Residual income[d] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7÷8
Citrus, Subtropical Fruit									
i,c Valencia Oranges	packed box	335	$ 3.10	$1,039	$ 860	$ 90	$ 89	1.6	$ 56
c Lemons	packed box	335	4.40	1,474	1,207	123	144	1.5	96
c Avocados	Flat	400	2.07	828	526	108	194	1.5	129
Deciduous Fruits and Nuts									
i Walnuts	ton	1.0	502.00	502	362	50	90	1.8	50
c Apricots	ton	8.5	67.73	576	478	68	30	1.7	18
Truck Crops									
c Spinach	ton	10	32.00	320	250	32	38	1.4	27
c Broccoli	ton	2.75	120.00	330	260	33	37	1.4	26
c Cabbage	crate	300	2.27	681	505	36	140	1.4	100
c Green Lima Beans	cwt	50	7.46	373	263	37	73	1.4	52
c Dry Chile Peppers	ton	1.5	419.00	629	432	63	134	1.4	96
c Lettuce	crate	300	2.32	696	595	28	73	1.4	52
c Tomatoes	ton	20	25.86	517	362	52	103	1.4	74
c Strawberries	tray	2,000	2.39	4,780	3,811	338	631	1.4	451

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN THE VENTURA COUNTY SERVICE AREA
(continued)

Crop[a]	1 Produc-tion unit	2 Yield[b]	3 Average: F.O.B. prices received: 1952-56	4 Gross income 4=2x3	5 Crop produc-tion costs[c]	6 Operator's labor and management	7 Residual income[d] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7÷8
Field Crops									
c Sugar Beets	ton	20	$ 14.40	$ 288	$ 225	$ 34	$ 29	1.8	$ 16
i,c Dry Lima Beans	cwt	30	10.54	316	217	32	67	1.7	39
i,c Alfalfa Hay	ton	7.0	30.07	210	155	21	34	2.9	12
i,c Barley	cwt	30	2.58	77	65	8	4	1.0	4
i,c Irrigated Pasture	AUM[e]	12	7.00	84	52	8	24	3.0	8

Note: Columns 2 through 8 expressed as values per acre.

a. c = coastal areas.
   i = inland areas.

b. On better lands mostly of "V" and "H" classes.

c. All costs except irrigation water are included.

d. A maximum residual above all varm operating costs available to pay for water and as operator's incentive to farm.

e. AUM is an animal unit month equal to .4 ton of alfalfa hay.

TABLE 100

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN COASTAL LOS ANGELES COUNTY AND ORANGE COUNTY

Crop	1 Production unit	2 Yield[a]	3 Average: F.O.B. prices received: 1952-56	4 Gross income 4=2x3	5 Crop production costs[b]	6 Operator's labor and management	7 Residual income[c] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7÷8
Citrus, Subtropical Fruit									
Navel Oranges	packed box	280	$ 3.50	$ 980	$ 781	$ 77	$122	2.1	$ 58
Valencia Oranges	packed box	300	3.00	900	783	67	50	2.1	24
Lemons	packed box	350	4.28	1,498	1,129	97	272	2.1	130
Avocados	flat	345	2.23	769	576	111	82	2.1	39
Truck Crops									
Celery	crate	1,000	2.39	2,390	2,175	114	101	1.7	59
Mustard Greens	crate	500	1.19	595	437	70	88	1.7	52
Strawberries	flat	1,500	2.25	3,375	2,804	223	348	1.7	205
Radishes	crate	300	1.21	363	206	86	71	1.7	42
Snap Beans	cwt	180	7.83	1,409	900	191	318	1.7	187
Field Crops									
Dry Lima Beans	cwt	25	10.79	270	205	27	38	1.7	22
Blackeye Beans	cwt	25	9.44	236	150	33	53	1.7	31
Sugar Beets	ton	20	11.73	235	200	23	12	1.7	7
Irrigated Pasture	AUM[d]	12	7.00	84	52	8	24	3.6	7

Note: Columns 2 through 8 expressed as values per acre.

a. Based upon better than average yields obtained in the area.

b. All costs except irrigation water are included.

c. A maximum residual above all farm operating costs available to pay for water and as operator's incentive to farm.

d. AUM is an animal unit month equal to .4 ton of alfalfa hay.

TABLE 101

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN COASTAL SAN BERNARDINO COUNTY

Crop	1 Production unit	2 Yield[a]	3 Average: F.O.B. prices received: 1952-56	4 Gross income: 4=2x3	5 Crop production costs[b]	6 Operator's labor and management	7 Residual income[c] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7÷8
Citrus Fruit									
Navel Oranges	packed box	280	$ 3.71	$1,039	$ 773	$ 78	$188	2.5	$ 75
Grapefruit	packed box	560	2.29	1,282	1,007	80	195	2.5	78
Lemons	packed box	335	4.47	1,497	1,132	94	271	2.5	108
Deciduous Fruits, Nuts, and Vines									
Peaches	lug	700	1.53	1,071	806	163	102	2.2	46
Plums	lug	350	2.36	826	617	147	62	2.2	28
Truck Crops									
Strawberries	tray	1,500	2.25	3,375	1,944	264	1,167	2.2	530
Cabbage	crate	300	2.38	714	427	146	141	2.2	64
Sweet Corn	crate	200	2.13	426	357	58	11	2.2	5
Endive	crate	1,000	1.00	1,000	544	174	282	2.2	128
Italian Onions	50-lb. sack	400	1.75	700	535	123	42	2.2	19
Dry Onions	50-lb. sack	1,000	1.38	1,380	1,104	98	178	2.2	81

IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL
CROPS IN COASTAL SAN BERNARDINO COUNTY
(continued)

Crop	1 Production unit	2 Yield[a]	3 Average: F.O.B. prices received: 1952-56	4 Gross income 4=2x3	5 Crop production costs[b]	6 Operator's labor and management	7 Residual income[c] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7÷8
Truck Crops (continued)									
Spring Potatoes	cwt	300	$ 3.04	$ 912	$ 681	$ 72	$ 159	2.2	$ 72
Sweet Potatoes	box	250	2.96	740	445	112	183	2.2	83
Field Crops									
Alfalfa Hay	ton	8	30.00	240	165	31	44	3.5	13
Blackeye Beans	cwt	20	9.75	195	138	23	34	1.4	24
Cover Crop	acre	--	25/ac.	25	17	5	3	0.7	4
Irrigated Pasture	AUM[d]	14	7.00	98	58	11	29	3.5	8
Miscellaneous Crops									
Ornamental Plants	1,000	5	1.50	7,500	4,472	534	2,494	2.0	1,247
Roses	1,000	9	.25	2,250	1,911	195	144	2.0	72
Shade Trees	1,000	5	1.00	5,000	3,510	308	1,182	2.0	591

Note: Columns 2 through 8 expressed as values per acre.

a. Based upon better than average yields obtained in the area.

b. All costs except irrigation water are included.

c. A maximum residual above all farm operating costs available to pay for water and as operator's incentive to farm.

d. AUM is an animal unit month equal to .4 ton of alfalfa hay.

TABLE 102

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN COASTAL RIVERSIDE COUNTY

Crop	1 Production unit	2 Yield[a]	3 Average F.O.B. prices received 1952-56	4 Gross income 4=2x3	5 Crop production costs[b]	6 Operator's labor and management	7 Residual income[c] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7÷8
Citrus Fruit									
Navel Oranges	packed box	280	$ 3.99	$1,117	$ 773	$ 86	$258	2.7	$ 96
Valencia Oranges	packed box	250	3.59	898	733	67	98	2.7	36
Grapefruit	packed box	560	2.88	1,613	1,007	113	493	2.7	183
Lemons	packed box	335	4.55	1,524	1,132	97	295	2.7	109
Deciduous Fruits									
Apricots	ton	9	87.80	790	630	67	93	2.2	42
Cherries	box	U-pick	1000/ac	1,000	732	175	93	2.2	42
Peaches	box	700	1.76	1,232	806	179	247	2.2	112
Plums	box	350	2.36	826	617	147	62	2.2	28
Truck Crops									
Watermelons	ton	20	31.12	622	334	63	225	2.2	102
Cantaloupes	crate	300	2.46	738	487	59	192	2.2	87
Dry Onions	sack	1,000	1.53	1,530	1,104	113	313	2.2	142
Spring Potatoes	cwt	300	2.83	849	681	56	112	2.2	51

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN COASTAL RIVERSIDE COUNTY
(continued)

Crop	1 Production unit	2 Yield[a]	3 Average: F.O.B. prices received: 1952-56	4 Gross income: 4=2x3	5 Crop production costs[b]	6 Operator's labor and management	7 Residual income[c] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7+8
Truck Crops (continued)									
Fall Potatoes	cwt	200	$ 2.83	$ 566	$ 468	$ 40	$ 58	2.2	$ 26
Sweet Potatoes	box	250	2.96	740	445	112	183	2.2	83
Field Crops									
Alfalfa Hay	ton	8	26.34	211	165	28	18	4.7	4
Alfalfa Seed	pound	550	.30	165	118	17	30	4.7	6
Blackeye Beans	cwt	20	9.75	195	138	23	34	1.4	24
Ensilage	ton	20	8.50	170	141	19	10	2.2	5
Cover Crop	acre		25/ac	25	17	5	3	0.8	4
Irrigated Pasture	AUM[d]	14	7.00	98	52	8	38	4.7	8

Note: Columns 2 through 8 expressed as values per acre.

a. Based upon better than average yields obtained in the area.

b. All costs except irrigation water are included.

c. A maximum residual above all farm operating costs available to pay for water and as operator's incentive to farm.

d. AUM is an animal unit month equal to .4 ton of alfalfa hay.

TABLE 103

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN COASTAL SAN DIEGO COUNTY

Crop	1 Production unit	2 Yield[a]	3 Average: F.O.B. prices received: 1952-56	4 Gross income 4=2x3	5 Crop production costs[b]	6 Operator's labor and management	7 Residual income[c] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7÷8
Citrus, Subtropical Fruit									
Lemons	packed box	300	$ 4.55	$1,365	$1,000	$117	$248	1.9	$131
Valencia Oranges	packed box	270	2.97	802	690	71	41	1.9	22
Avocados	ton	2.5	408.00	1,020	600	112	308	1.9	162
Deciduous Fruits									
Peaches	ton	5.0	185.00	925	700	98	127	2.1	61
Truck Crops									
Strawberries	tray	1,500	2.16	3,240	2,800	184	256	1.9	135
Green Beans	cwt	122	10.83	1,321	1,020	132	169	1.9	89
Celery	crate	950	2.50	2,375	2,120	138	117	1.9	62
Lettuce	crate	350	2.23	781	550	30	201	1.9	106
Tomatoes, Spring	flat	1,600	1.90	3,040	2,066	238	736	1.9	387
Tomatoes, Fall	flat	1,950	1.90	3,705	2,501	270	934	1.9	492
Cabbage	crate	300	1.70	510	384	19	107	1.9	56
Cucumbers	lug	1,000	1.70	1,700	1,200	138	362	1.9	191
Peppers, Dry Chile	ton	1.5	419.00	629	450	63	116	1.9	61

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN COASTAL SAN DIEGO COUNTY

(continued)

Crop	1 Production unit	2 Yield[a]	3 Average F.O.B. prices received 1952-56	4 Gross income 4=2x3	5 Crop production costs[b]	6 Operator's labor and management	7 Residual income[c] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7÷8
Field Crops									
Alfalfa Hay	ton	7.0	$ 29.00	$ 203	$ 165	$ 30	$ 8	3.3	$ 2
Irrigated Pasture	AUM[d]	12	7.00	84	52	8	24	3.3	7
Dry Lima Beans	cwt	25	10.83	271	205	37	29	1.7	17

Note: Columns 2 through 8 expressed as values per acre.

a. Based upon better than average yields obtained in the area.

b. All costs except irrigation water are included.

c. A maximum residual above all farm operating costs available to pay for water and as operator's incentive to farm.

d. AUM is an animal unit month equivalent to .4 ton of alfalfa hay.

TABLE 104

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN THE ANTELOPE-MOJAVE SERVICE AREA

Crop	1 Production unit	2 Yield[a]	3 Average: F.O.B. prices received: 1952-56	4 Gross income 4=2x3	5 Crop production costs[b]	6 Operator's labor and management	7 Residual income[c] 7=4-(5+6)	8 Use of applied water acre-feet	9 Residual income per acre-foot 9=7÷8
Truck Crops									
Cantaloupes	crate	200	$ 3.00	$ 600	$477	$42	$ 81	2.9	$28
Carrots	crate	300	3.20	960	843	40	77	2.9	27
Onions	sack	900	1.20	1,080	868	72	140	2.9	48
Potatoes	cwt	275	2.50	688	488	33	167	2.9	58
Field Crops									
Alfalfa Hay	ton	6	26.50	159	118	26	15	5.9	3
Alfalfa Seed	pound	700	.30	237	149	34	54	5.9	9
Irrigated Pasture	AUM[d]	12	7.00	84	47	8	29	5.5	5
Field Corn	ton	3	65.00	195	118	30	47	4.1	11
Milo	cwt	45	2.75	124	82	22	20	1.7	12
Wheat	cwt	40	3.50	140	87	24	29	1.7	17

Note: Columns 2 through 8 expressed as values per acre.

a. Based upon better than average yields obtained in the area.

b. All costs except irrigation water are included.

c. A maximum residual above all farm operating costs available to pay for water and as operator's incentive to farm.

d. AUM is an animal unit month equal to .4 ton of alfalfa hay.

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN THE KERN COUNTY SERVICE AREA

Crop	1 Production unit	2 Land class[a]	3 Yield	4 Average: F.O.B. prices received: 1952-56	5 Gross income: 5=3x4	6 Crop production costs[b]	7 Operator's labor and management	8 Residual income[c] 8=5-(6+7)	9 Use of applied water acre-feet	10 Residual income per acre-foot 10=8÷9
Cotton	bale	Vls	1.60	$165.00	$264	$151	$ 37	$ 76	3.3	$23
Milo	ton	Vls	2.00	54.00	108	73	16	19	1.1	17
Grapes, table	ton	Hl	7.00	65.00	455	274	68	113	3.1	36
Navel Oranges	field box	Hl	350.00	1.70	595	436	85	74	2.9	26
Navel Oranges	field box	Hp	350.00	1.70	595	436	85	74	2.9	26
Grapes, table	ton	Hp	6.00	65.00	390	245	62	83	3.1	27
Irrigated pasture	AUM[d]	Vp	12.50	7.00	88	35	23	30	4.4	7
Cotton	bale	Vp	1.30	165.00	214	137	32	46	3.1	15
Navel Oranges	field box	Vp	350.00	1.70	595	436	85	74	3.1	24
Rice	cwt	Vp	35.00	4.50	158	123	22	13	5.9	2
Irrigated pasture	AUM[d]	Vps	11.00	7.00	77	29	20	8	4.4	2
Cotton	bale	Vps	1.30	165.00	214	130	32	52	3.3	16
Grain	cwt	Vps	1.25	48.00	60	49	4	7	1.1	6
Rice	cwt	Vps	35.00	4.50	158	123	22	13	6.3	2
Navel Oranges	field box	Vr, Hr(Hpr (Vrl (	350.00	1.70	595	436	85	74	2.9	26

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN THE KERN COUNTY SERVICE AREA

(continued)

Crop	1 Production unit	2 Land class[a]	3 Yield	4 Average F.O.B. prices received: 1952-56	5 Gross income 5=3x4	6 Crop production costs[b]	7 Operator's labor and management	8 Residual income[c] 8=5-(6+7)	9 Use of applied water acre-feet	10 Residual income per acre-foot 10=8÷9
Grapes, table	ton	Htrl	6.00	$ 65.00	$390	$245	$ 62	$ 83	3.1	$27
Alfalfa hay	ton	V	7.50	24.00	180	124	26	30	3.9	8
Alfalfa seed	lb.	V	625.00	.34	212	150	30	32	3.2	10
Potatoes	cwt	V	270.00	2.65	716	504	77	135	3.0	45
Melons	crate	V	200.00	3.25	650	459	75	116	2.4	48
Cotton	bale	V	2.00	165.00	330	175	43	112	2.9	39
Grain	ton	V	1.50	48.00	72	46	5	21	1.1	19
Sugar Beets	ton	V	24.00	12.50	300	186	37	77	2.0	38
Plums	ton	V	4.00	160.00	640	345	129	166	2.9	57
Navel Oranges	field box	V	400.00	1.70	680	458	102	120	2.9	41
Rice	cwt	V	35.00	4.50	158	123	22	13	6.3	2
Alfalfa hay	ton	Vs	6.50	24.00	156	108	27	21	4.0	5
Alfalfa seed	lb.	Vs	575.00	.34	196	142	29	25	2.5	10
Irrigated Pasture	lb.	Vs	840.00	.20	168	119	25	24	4.1	6
Cotton	bale	Vs	2.00	165.00	330	175	43	112	2.9	39
Potatoes	cwt	Vs	250.00	2.65	663	444	72	147	2.0	74
Milo	ton	Vs	2.50	54.00	135	90	18	27	1.1	25
Sugar Beets	ton	Vs	21.50	12.50	269	182	34	53	2.5	21
Melons	crate	Vs	160.00	3.25	520	389	62	69	1.4	49
Grain	ton	Vs	1.50	48.00	72	56	5	11	1.1	10
Rice	cwt	Vs	35.00	4.50	158	123	22	13	6.8	2
Plums	ton	H	4.00	160.00	640	345	129	166	2.9	57
Grapes, table	ton	H	7.00	65.00	455	274	68	113	3.1	36
Navel Oranges	field box	H	400.00	1.70	680	458	102	120	2.9	41

DERIVATION OF UNIT RESIDUAL ANNUAL INCOME FOR PAYMENT FOR IRRIGATION WATER AND FARMING INCENTIVE BY PRINCIPAL CROPS IN THE KERN COUNTY SERVICE AREA
(continued)

Crop	1 Produc-tion unit	2 Land class[a]	3 Yield	4 Average: F.O.B. prices received: 1952-56	5 Gross income 5=3x4	6 Crop Produc-tion costs[b]	7 Operator's labor and management	8 Residual income[c] 8=5-(6+7)	9 Use of applied water acre-feet	10 Residual income per acre-foot 10=8÷9
Alfalfa Hay	ton	Vl	6.50	$ 24.00	$156	$108	$ 24	$ 24	4.4	$ 5
Grapes, table	ton	Vl	7.00	65.00	455	274	68	113	3.6	31
Alfalfa seed	lb	Vl	575.00	.34	196	138	29	29	3.7	8
Potatoes	cwt	Vl	250.00	2.65	662	465	72	125	3.8	33
Grain	cwt	Vl	1.25	48.00	60	46	5	9	1.1	8
Cotton	bale	Vl	1.60	165.00	264	151	37	76	3.3	23
Plums	ton	Vl	3.50	160.00	560	307	117	136	3.3	41
Navel Oranges	field	Vl	350.00	1.70	595	436	85	74	3.3	22

Note: Columns 3 through 9 expressed as values per acre

a. V - Smooth lying valley lands suitable for all climatically adapted crops.
H - Hill lands with maximum slope of 20 per cent suitable for all climatically adapted crops.
l - Coarse textured soils.
p - Shallow effective root zone.
r - Rocks present within plow zone prevent using the land for cultivated crops.
s - Saline and alkaline salts present in soil.
t - Hill lands with maximum slopes up to 30 per cent.

b. All costs except irrigation water are included.

c. A maximum residual above all farm operating costs except irrigation water available to pay for water and as operator's incentive to farm.

d. AUM is an animal unit month equal to .4 ton of alfalfa hay.

ATTACHMENT NO. 13

DERIVATION OF ANNUAL RETURN TO CAPITAL INVESTMENT IN FARMS BY PRINCIPAL CROPS BY COUNTIES

TABLE 106

DERIVATION OF ANNUAL RETURN TO INVESTMENT FOR IRRIGATED CROPS IN THE SAN LUIS OBISPO SERVICE AREA

Crop[a]		Equity investment per acre	Gross income per acre	Total expenses per acre[b]	Return		Return per farm
					Per acre	Per cent	
Artichokes	- c	$1,313	$ 604	$ 384	$220	16.8	$11,000
String Beans	- c	750	1,128	938	190	25.3	7,600
Cauliflower	- c	750	665	657	8	1.1	320
Celery	- c	750	2,230	2,045	185	24.7	7,400
Cucumbers	- c	750	1,050	645	405	54.0	16,200
Lettuce	- c	750	739	655	84	11.2	3,360
Potatoes	- i	765	638	584	54	7.1	4,320
Bell Peppers	- i	750	885	609	276	36.8	11,040
Strawberries	- i	1,238	3,120	2,160	960	77.5	9,600
Sugar Beets	- i	698	370	294	76	10.9	4,560
Walnuts	- i	983	517	328	189	19.2	7,560

a. Truck crop acreage double cropped 100 per cent except for strawberries.
c = coastal areas.
i = interior areas.

b. Includes all cash costs, preliminary estimated charges for project water, and depreciation; excludes management charge.

TABLE 107

DERIVATION OF ANNUAL RETURN TO INVESTMENT FOR IRRIGATED CROPS IN THE SANTA BARBARA SERVICE AREA

Crop[a]	Equity investment per acre	Gross income per acre	Total expenses per acre[b]	Return		Return per farm
				Per acre	Per cent	
Celery - i	$ 750	$2,080	$1,931	$149	19.9	$ 5,960
Potatoes - i	750	852	776	76	10.1	4,560
Snap Beans - i	750	534	481	53	7.1	2,120
Artichokes - i	1,313	500	418	82	6.2	4,100
Carrots - i	750	1,077	953	124	16.5	4,960
Cauliflower - i	750	665	657	8	1.1	320
Lettuce - i	750	767	631	136	18.1	5,440
Ensilage - i	450	213	187	26	5.8	3,120
Dry Beans - i	563	316	228	88	15.6	10,560
Sugar Beets - i	563	288	245	43	7.6	2,580
Flowers - i	1,800	2,950	2,403	547	30.4	10,940
Walnuts - i	908	524	320	204	22.5	8,160
Lemons - i	2,025	1,598	1,170	428	21.1	12,840
Valencia Oranges - i	2,025	1,039	854	185	9.1	5,550
Snap Beans - c	750	534	498	36	4.8	1,440
Flowers - c	1,800	2,950	2,315	635	35.3	12,700
Walnuts - c	983	524	341	183	18.6	7,320
Lemons - c	2,025	1,598	1,182	416	20.5	12,480
Valencia Oranges - c	2,025	1,039	839	200	9.9	6,000
Avocados - c	2,025	730	455	275	13.6	4,125

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a. Truck crop acreage double cropped 100 per cent.
c = coastal areas.
i = interior areas.

b. Includes all cash costs, preliminary estimated charges for project water, and depreciation; excludes management charge.

TABLE 108

DERIVATION OF ANNUAL RETURN TO INVESTMENT FOR IRRIGATED CROPS IN THE VENTURA COUNTY SERVICE AREA

Crop[a]	Equity investment per acre	Gross income per acre	Total expenses per acre[b]	Return Per acre	Return Per cent	Return per farm
Spinach	$ 900	$ 320	$ 289	$ 31	3.4	$1,240
Cabbage	900	681	544	137	15.2	5,480
Broccoli	900	330	299	31	3.4	1,240
Green Beans	900	373	302	71	7.9	2,840
Peppers	900	629	471	158	17.6	6,320
Lettuce	900	696	634	62	6.9	2,480
Tomatoes	900	517	401	116	12.9	4,640
Strawberries	2,100	4,780	3,790	990	47.1	9,900
Dry Lima Beans	975	316	270	46	4.7	2,760
Flowers	1,800	2,950	2,533	417	23.2	8,340
Walnuts	1,350	502	403	99	7.3	3,960
Lemons	2,025	1,474	1,206	268	13.2	8,040
Valencia Oranges	2,025	1,039	865	174	8.6	5,220
Avocados	2,025	828	517	311	15.4	4,670

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a. Truck crop acreage double cropped 100 per cent except for strawberries.

b. Includes all cash costs, preliminary estimated charges for project water, and depreciation; excludes management charge.

TABLE 109

DERIVATION OF ANNUAL RETURN TO INVESTMENT FOR IRRIGATED CROPS IN COASTAL RIVERSIDE COUNTY

Crop[a]	Equity investment per acre	Gross income per acre	Total expenses per acre[b]	Return Per acre	Return Per cent	Return per farm
Watermelons	$ 900	$ 622	$ 449	$173	19.2	$ 6,920
Cantaloupes	900	738	571	167	18.6	6,680
Onions	450	1,530	1,188	342	76.0	13,680
Spring Potatoes	750	849	760	89	11.9	7,120
Fall Potatoes	750	566	547	19	2.5	1,520
Sweet Potatoes	1,313	740	536	204	15.5	8,160
Navel Oranges	1,725	1,117	823	294	17.0	11,760
Valencia Oranges	1,725	898	783	115	6.7	4,600
Grapefruit	1,725	1,613	1,057	556	32.2	22,240

a. Truck crop acreage double cropped 75 per cent.

b. Includes all cash costs, preliminary estimated charges for project water, and depreciation; excludes management charge.

TABLE 110

DERIVATION OF ANNUAL RETURN TO INVESTMENT FOR IRRIGATED CROPS IN COASTAL SAN DIEGO AND SOUTHWESTERN RIVERSIDE COUNTIES

Crop	Equity investment per acre	Gross income per acre	Total expenses per acre[a]	Return		Return per farm
				Per acre	Per cent	
Green Beans[b]	$ 900	$1,321	$1,067	$ 254	28.2	$10,160
Celery[b]	900	1,250	1,042	208	23.1	8,320
Lettuce[b]	900	781	576	205	22.8	8,200
Cabbage[b]	900	510	402	108	12.0	4,320
Cucumbers[b]	900	1,700	1,244	456	50.7	18,240
Peppers[b]	900	629	497	132	14.7	5,280
Spring Potatoes[c]	750	849	760	89	11.9	7,120
Fall Potatoes[c]	750	566	547	19	2.5	1,520
Dry Onions[c]	450	1,530	1,188	342	76.0	13,680
Spring Tomatoes	1,800	3,040	2,070	970	53.9	19,400
Fall Tomatoes	1,800	3,705	2,512	1,193	66.3	23,860
Strawberries	1,500	3,240	2,817	423	28.2	6,345
Cut Flowers	1,800	2,950	2,533	417	23.2	8,340
Peaches	1,200	925	747	178	14.8	7,120
Lemons	1,500	1,365	1,028	337	22.5	10,110
Valencia Oranges	1,500	802	717	85	5.7	2,550
Avocados	1,500	1,020	627	393	26.2	11,790

a. Includes all cash costs, preliminary estimated charges for project water, and depreciation; excludes management charge.
b. This truck crop acreage double cropped 100 per cent.
c. This truck crop acreage double cropped 75 per cent.

TABLE 111

DERIVATION OF ANNUAL RETURN TO INVESTMENT FOR IRRIGATED CROPS IN THE KERN COUNTY SERVICE AREA

Crop	Land class[a]	Equity investment per acre	Gross income per acre	Total expenses per acre[b]	Return		Return per farm
					Per acre	Per cent	
Potatoes	V, Vs	$363	$678	$513	$165	45.4	$13,200
Potatoes	Vl	313	663	579	84	26.8	6,720
Potatoes	All	359	677	518	159	44.2	12,720
Melons	V, Vs	363	605	488	117	32.2	9,360
All Truck	All	362	631	500	131	36.3	10,480
Cotton	V, Vs	350	332	239	93	26.6	11,160
Cotton	Vl, Vls	250	266	213	53	21.2	6,360
Cotton	Vhs, Vp, Vps	220	240	197	43	19.5	5,160
Cotton	All	328	316	232	84	25.6	10,080
Sugar Beets	V, Vs, Vsa	300	280	229	51	17.0	6,120
Sugar Beets	Vhs, Vp	200	240	214	26	13.0	3,120
Sugar Beets	Vh, Vps	200	240	211	29	14.5	3,480
Sugar Beets	All	296	279	228	51	17.2	6,120
Alfalfa Seed	V, Vs	379	203	192	11	2.9	1,760
Alfalfa Seed	Vl, Vls	279	196	176	20	7.2	3,200
Alfalfa Seed	All	374	203	191	12	3.1	1,920
Milo	Vs	288	135	116	19	6.6	4,560
Grain	V, Vs, Vp	173	72	68	4	2.3	960
Table Grapes	V, Vs	513	447	363	84	16.4	5,242
Table Grapes	Vl	525	455	331	124	23.6	7,440
Table Grapes	H	525	455	374	81	15.4	4,860
Table Grapes	Hl	525	455	355	100	19.0	6,000
Table Grapes	Hp, Ht	425	390	353	37	8.7	2,960
Table Grapes	Vr, Hr	435	396	352	44	10.1	3,432
Table Grapes	All	502	441	363	78	15.4	5,030
Plums	V, H	648	640	465	175	27.0	7,000
Plums	Vl, Vr	504	563	463	100	19.8	4,000
Plums	Hl, Ht, Htr	498	560	422	138	27.7	5,520
Plums	All	635	633	463	170	26.8	6,800

DERIVATION OF ANNUAL RETURN TO INVESTMENT FOR IRRIGATED CROPS IN THE KERN COUNTY SERVICE AREA
(continued)

Crop	Land class[a]	Equity investment per acre	Gross income per acre	Total expenses per acre[b]	Return		Return per farm
					Per acre	Per cent	
Navel Oranges	V, H	$788	$680	$582	$ 98	12.4	$ 3,920
Navel Oranges	Vr, Hr	658	595	548	47	7.1	2,820
Navel Oranges	Hp, Ht, Htr	664	599	538	61	10.2	3,600
Navel Oranges	All	773	670	576	94	12.2	3,976

[a] V - Smooth lying valley lands suitable for all climatically adapted crops.
H - Hill lands with maximum slope of 20 per cent suitable for all climatically adapted crops.
l - Coarse textured soils.
h - Very heavy textured soils.
p - Shallow effective root zone.
r - Rocks present within plow zone prevent using the land for cultivated crops.
s - Saline and alkaline salts present in soil.
t - Hill lands with maximum slopes up to 30 per cent.

[b] Includes all cash costs, preliminary estimated charges for water, and depreciation; excludes management charge.

ATTACHMENT NO. 14

PROJECTED NET ACREAGES OF IRRIGATED CROPS BY COUNTIES

TABLE 112

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN THE SAN LUIS OBISPO SERVICE AREA

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa	9,505	8,825	9,600	9,500	9,500	10,000	9,600
Irrigated Pasture	3,380	3,535	3,600	3,800	3,900	4,150	3,800
Field Crops	1,795	2,125	2,650	2,700	2,600	2,500	2,700
Hay and Grain	1,080	1,050	1,050	1,050	1,050	1,150	1,050
Truck Crops	3,470	5,875	11,000	20,650	21,050	18,800	15,950
Flowers	150	150	100	100	100	0	0
Deciduous Fruits*	250	1,150	2,700	4,900	5,300	5,500	5,400
TOTALS	19,630	22,700	30,700	42,700	43,500	42,100	38,500

*Includes nuts and vines.

TABLE 113

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN THE SANTA BARBARA SERVICE AREA

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa	5,875	6,385	6,060	6,060	5,860	5,860	5,860
Irrigated Pasture	6,545	7,000	6,625	6,625	6,850	6,800	6,800
Field Crops	15,600	13,300	12,800	12,800	10,840	10,850	10,850
Hay and Grain	230	100	100	100	100	100	100
Truck Crops	26,530	26,550	33,650	36,800	36,500	36,500	36,400
Flowers	2,900	3,175	4,000	4,200	4,400	4,400	4,400
Deciduous Fruits*	2,710	2,985	3,985	4,685	4,310	4,310	4,310
Lemons	10,500	10,640	12,890	14,240	15,240	18,540	19,040
Oranges	400	480	1,000	1,400	1,450	1,450	1,550
Avocados	710	985	1,490	1,990	3,450	3,590	3,590
TOTALS	72,000	71,600	82,600	88,900	89,000	92,400	92,900

*Includes nuts and vines.

TABLE 114

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN THE VENTURA COUNTY SERVICE AREA

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa	2,075	1,975	1,400	1,200	1,100	900	800
Irrigated Pasture	1,125	1,125	800	700	700	500	500
Field Crops	30,200	23,500	19,700	14,000	10,700	5,600	4,600
Hay and Grain	900	400	200	0	0	0	0
Truck Crops	19,900	18,400	15,700	13,300	9,900	7,900	5,800
Flowers	200	200	200	200	200	200	200
Deciduous Fruits*	13,300	13,900	12,300	11,200	10,500	8,900	7,900
Lemons	28,500	35,900	33,600	29,900	28,400	22,300	18,200
Oranges	23,400	24,100	22,400	20,100	18,800	14,400	10,500
Avocados	2,400	4,500	4,200	3,900	3,700	2,900	2,300
TOTALS	122,000	124,000	110,500	94,500	84,000	63,600	50,800

*Includes nuts and vines.

TABLE 115

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN COASTAL LOS ANGELES COUNTY

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa	10,750	2,500	300	0	0	0	0
Field Crops	1,300	500	100	0	0	0	0
Truck Crops	4,950	1,400	500	0	0	0	0
Deciduous Fruits*	1,530	200	0	0	0	0	0
Oranges	4,070	800	0	0	0	0	0
TOTALS	22,600	5,400	900	0	0	0	0

*Includes nuts and vines.

TABLE 116

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN ORANGE COUNTY

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa	5,200	2,000	0	0	0	0	0
Field Crops	17,700	10,100	1,000	0	0	0	0
Truck Crops	20,200	16,400	5,800	3,400	1,700	0	0
Deciduous Fruits*	600	0	0	0	0	0	0
Oranges	43,100	25,300	11,400	7,600	4,400	900	0
TOTALS	86,800	53,800	18,200	11,000	6,100	900	0

*Includes nuts and vines.

TABLE 117

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN COASTAL SAN BERNARDINO COUNTY

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa	3,860	3,159	2,430	1,190	260	0	0
Irrigated Pasture	7,340	5,591	4,270	2,010	440	0	0
Field Crops	1,000	725	345	210	240	90	0
Hay and Grain	700	525	205	90	60	10	0
Truck Crops	15,050	15,200	14,500	12,100	8,400	4,800	0
Flowers	2,350	1,850	1,030	655	320	105	0
Deciduous Fruits*	17,900	12,800	7,050	4,100	1,700	700	300
Lemons	6,541	5,742	4,362	2,102	1,272	1,147	0
Oranges	25,055	21,700	13,900	8,035	5,100	940	0
Avocados	4	8	8	8	8	8	0
TOTALS	79,800	67,300	48,100	30,500	17,800	7,800	300

*Includes nuts and vines.

TABLE 118

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN COASTAL RIVERSIDE COUNTY

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa	8,500	7,400	5,700	3,000	2,300	1,400	600
Irrigated Pasture	7,800	6,600	5,500	3,200	2,000	500	300
Field Crops	1,500	2,100	2,600	5,000	5,900	5,600	6,100
Hay and Grain	7,300	6,800	5,400	4,700	3,800	3,200	4,000
Truck Crops	16,800	19,300	23,200	28,300	31,300	31,200	24,500
Deciduous Fruits*	11,500	10,100	7,500	5,600	3,800	2,900	2,600
Grapefruit	1,000	1,200	1,400	1,800	2,600	2,800	2,400
Lemons	3,300	2,700	2,300	1,800	1,300	1,000	200
Oranges	17,100	13,700	12,500	10,800	8,800	7,400	5,300
Avocados	300	300	200	200	100	0	0
TOTALS	75,100	70,200	66,300	64,400	61,900	56,000	46,000

*Includes nuts and vines.

TABLE 119

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN COASTAL SAN DIEGO AND SOUTHWESTERN RIVERSIDE COUNTIES

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa	3,750	1,500	1,250	850	600	500	500
Irrigated Pasture	3,750	1,500	1,250	850	600	500	500
Field Crops	1,500	0	0	0	0	0	0
Hay and Grain	6,500	700	300	0	0	0	0
Truck Crops	15,000	38,000	46,700	51,900	55,700	60,300	64,900
Flowers	1,500	1,300	1,500	1,700	1,800	2,100	1,900
Deciduous Fruits*	2,000	1,500	1,200	1,000	700	500	500
Citrus and Avocados	26,500	50,000	68,300	94,300	106,600	109,800	110,000
TOTALS	60,500	94,500	120,500	150,600	166,000	173,700	178,300

*Includes nuts and vines.

TABLE 120

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN THE ANTELOPE-MOJAVE SERVICE AREA[a]

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa	49,900	48,050	44,600	37,900	27,200	16,800	14,800
Irrigated Pasture	13,600	13,400	12,100	10,100	8,300	6,300	5,600
Field Crops	4,800	4,700	3,700	3,100	2,400	1,300	1,200
Hay and Grain	17,050	16,700	13,800	10,000	6,300	3,200	1,700
Truck Crops	2,500	3,000	3,800	4,400	5,300	4,700	4,200
Deciduous Fruits[b]	1,650	1,050	500	0	0	0	0
TOTALS	89,500	86,900	78,500	65,500	49,500	32,300	27,500

a. Comprises portions of Kern, Los Angeles, and San Bernardino Counties.

b. Includes nuts and vines.

TABLE 121

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN KERN COUNTY SERVICE AREA (SAN JOAQUIN VALLEY)

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa Hay	62,400	70,100	80,800	76,500	77,100	68,900	65,000
Alfalfa Seed	28,700	30,800	35,500	47,000	48,900	49,200	49,200
Pasture	11,500	15,000	24,700	26,300	26,800	23,900	22,500
Miscellaneous Field Crops	51,100	65,000	94,400	120,700	131,600	125,700	123,600
Hay and Grain	51,800	47,700	47,000	47,600	48,400	42,900	41,700
Truck Crops	6,800	13,800	26,700	43,200	46,900	46,900	46,800
Cotton	121,000	148,600	208,400	266,700	287,800	283,200	279,300
Potatoes	9,400	12,900	19,800	27,600	29,300	29,100	28,800
Sugar Beets	4,500	6,100	7,700	7,800	8,200	8,200	8,200
Rice	7,300	7,100	14,200	16,700	16,700	17,100	17,100
Deciduous Fruits and Nuts	100	5,100	22,200	45,600	55,100	57,600	57,600
Grapes	3,300	5,200	8,600	12,000	13,800	14,300	14,200
Citrus Fruit	0	4,200	16,500	33,700	40,700	42,600	42,600
TOTALS	357,900	431,600	606,500	771,400	831,300	809,600	796,600

TABLE 122

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN THE UPPER ANTELOPE PLAIN AREA OF KERN COUNTY

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa Seed	200	400	1,300	3,000	3,800	3,800	3,800
Miscellaneous Field Crops	1,600	2,100	5,800	13,900	17,700	17,700	17,700
Truck Crops	100	500	3,500	7,900	9,800	9,800	9,800
Cotton	1,800	5,000	15,600	36,000	46,500	46,500	46,500
Deciduous Fruits and Nuts	100	1,200	8,200	15,100	17,800	17,800	17,800
Grapes	0	200	1,400	3,200	4,400	4,400	4,400
Citrus Fruits	0	2,000	7,700	13,300	15,500	15,500	15,500
TOTALS	3,800	11,400	43,500	92,400	115,500	115,500	115,500

TABLE 123

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN THE AVENAL GAP TO PUMPING PLANT IN-III AREA OF KERN COUNTY

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa Hay	60,900	70,100	80,800	76,500	77,100	68,900	65,000
Alfalfa Seed	14,500	17,100	23,700	35,200	37,100	37,400	37,400
Irrigated Pasture	11,500	15,000	24,700	26,300	26,800	23,900	22,500
Miscellaneous Field Crops	48,300	60,400	85,600	100,600	107,400	102,200	100,100
Hay and Grain	47,200	47,700	47,000	47,600	48,400	42,900	41,700
Truck Crops	5,100	8,700	15,500	25,700	26,800	26,700	26,700
Cotton	101,200	125,200	171,800	212,300	222,600	218,400	214,500
Potatoes	5,200	6,600	11,900	18,900	20,400	20,100	19,800
Sugar Beets	3,200	3,600	4,500	4,100	4,200	4,200	4,200
Rice	7,300	7,100	14,200	16,700	16,700	17,100	17,100
Deciduous Fruits and Nuts	0	1,200	4,200	11,100	14,400	14,500	14,400
Grapes	3,200	3,900	5,300	6,400	6,600	6,500	6,400
Citrus Fruits	0	100	700	3,000	6,100	6,000	6,000
TOTALS	307,600	366,700	489,900	584,400	614,600	588,800	575,800

TABLE 124

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN THE PUMPING PLANT IN-III TO PUMPING PLANT IN-IV AREA OF KERN COUNTY

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa Hay	1,500	0	0	0	0	0	0
Alfalfa Seed	14,000	12,900	10,100	8,500	7,700	7,700	7,700
Field Crops	200	1,900	2,700	6,100	6,500	5,800	5,800
Hay and Grain	4,600	0	0	0	0	0	0
Truck Crops	800	3,100	5,200	6,600	7,100	7,100	7,000
Cotton	14,800	15,200	19,500	18,300	18,700	18,300	18,300
Potatoes	1,200	3,100	4,400	5,000	5,200	5,200	5,200
Sugar Beets	1,300	2,500	3,200	3,700	4,000	4,000	4,000
Deciduous Fruits and Nuts	0	900	5,400	12,000	15,100	17,300	17,400
Grapes	100	600	1,100	1,500	1,800	2,300	2,300
Citrus Fruit	0	1,900	6,100	11,700	12,800	14,500	14,500
TOTALS	38,500	42,100	57,700	73,400	78,900	82,200	82,200

TABLE 125

PROJECTED NET ACREAGES OF IRRIGATED CROPS IN THE PUMPING PLANT IN-IV TO PUMPING PLANT IN-VI AREA OF KERN COUNTY

Crop	1960	1970	1980	1990	2000	2010	2020
Alfalfa Seed	0	400	400	300	300	300	300
Miscellaneous Field Crops	1,000	600	300	100	0	0	0
Truck Crops	800	1,500	2,500	3,000	3,200	3,300	3,300
Cotton	3,200	3,200	1,500	100	0	0	0
Potatoes	3,000	3,200	3,500	3,700	3,700	3,800	3,800
Deciduous Fruits and Nuts	0	1,800	4,400	7,400	7,800	8,000	8,000
Grapes	0	500	800	900	1,000	1,100	1,100
Citrus Fruit	0	200	2,000	5,700	6,300	6,600	6,600
TOTALS	8,000	11,400	15,400	21,200	22,300	23,100	23,100

ATTACHMENT NO. 15

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◆

INVESTIGATION OF ALTERNATIVE
EDUCT SYSTEMS TO SERVE SOUTHERN CALIFORNIA

◆

LOCATION OF INVESTIGATIONAL AREA
1959

Scale of Miles
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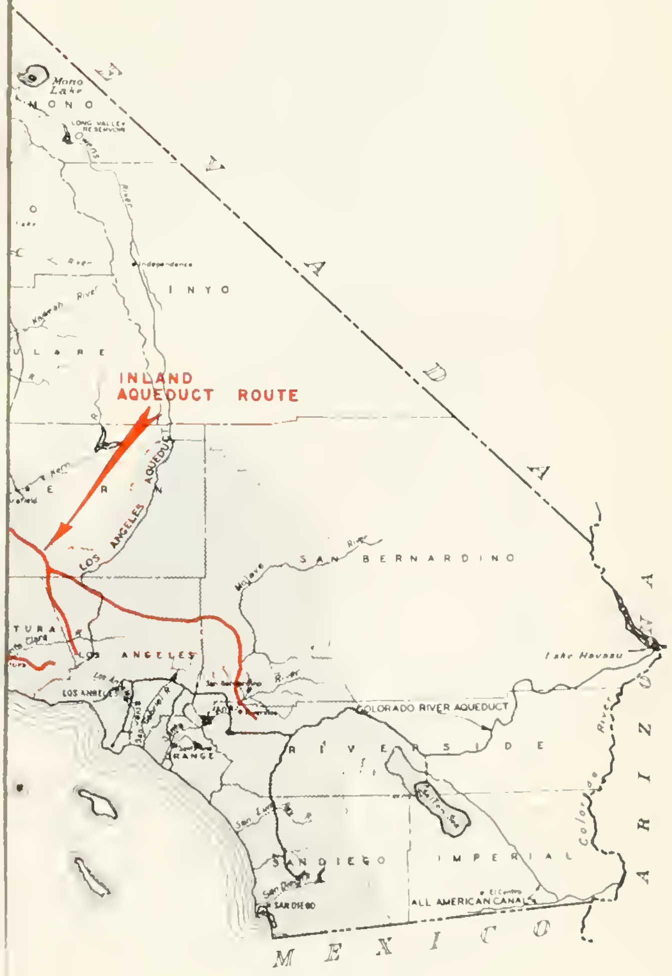

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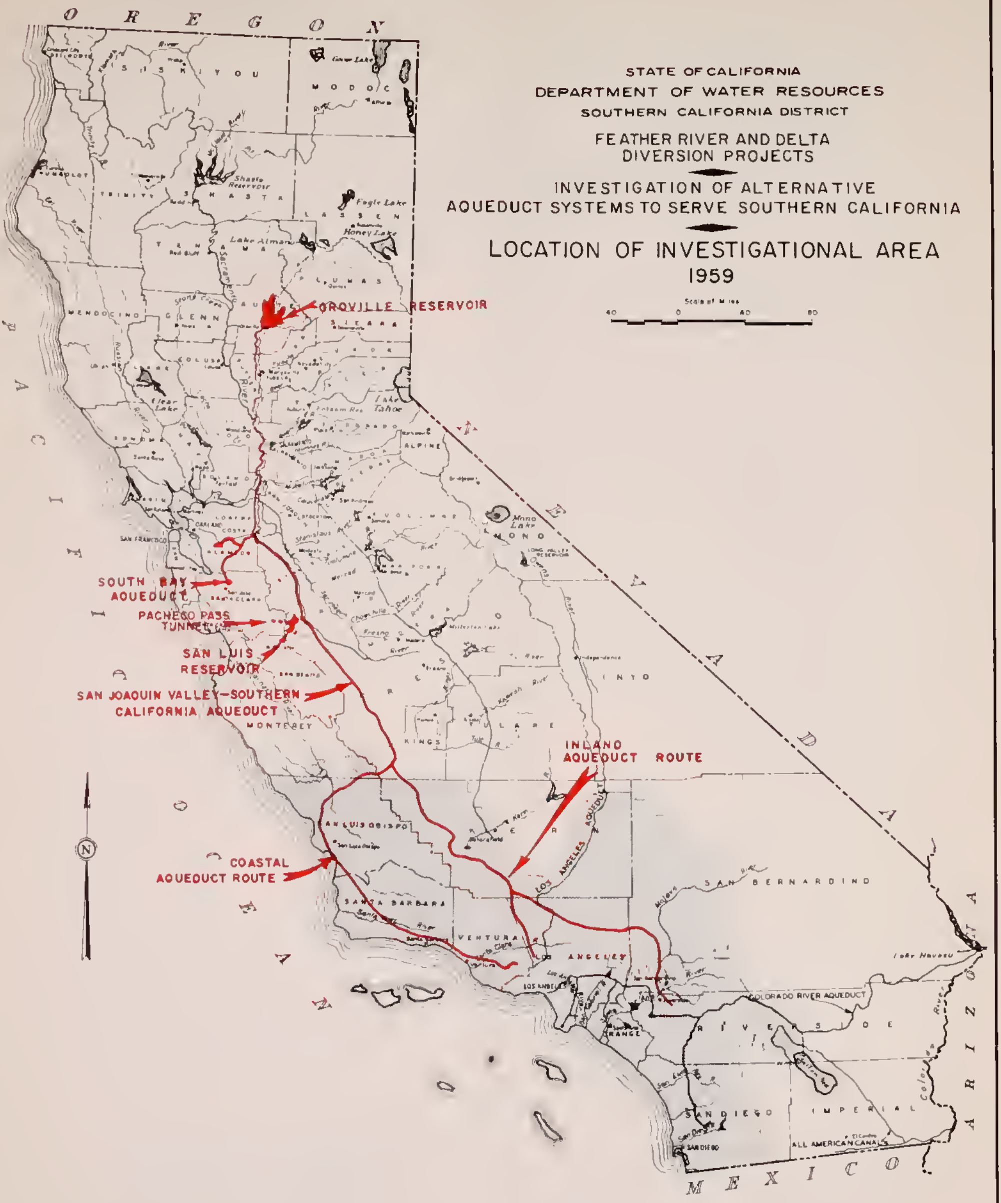

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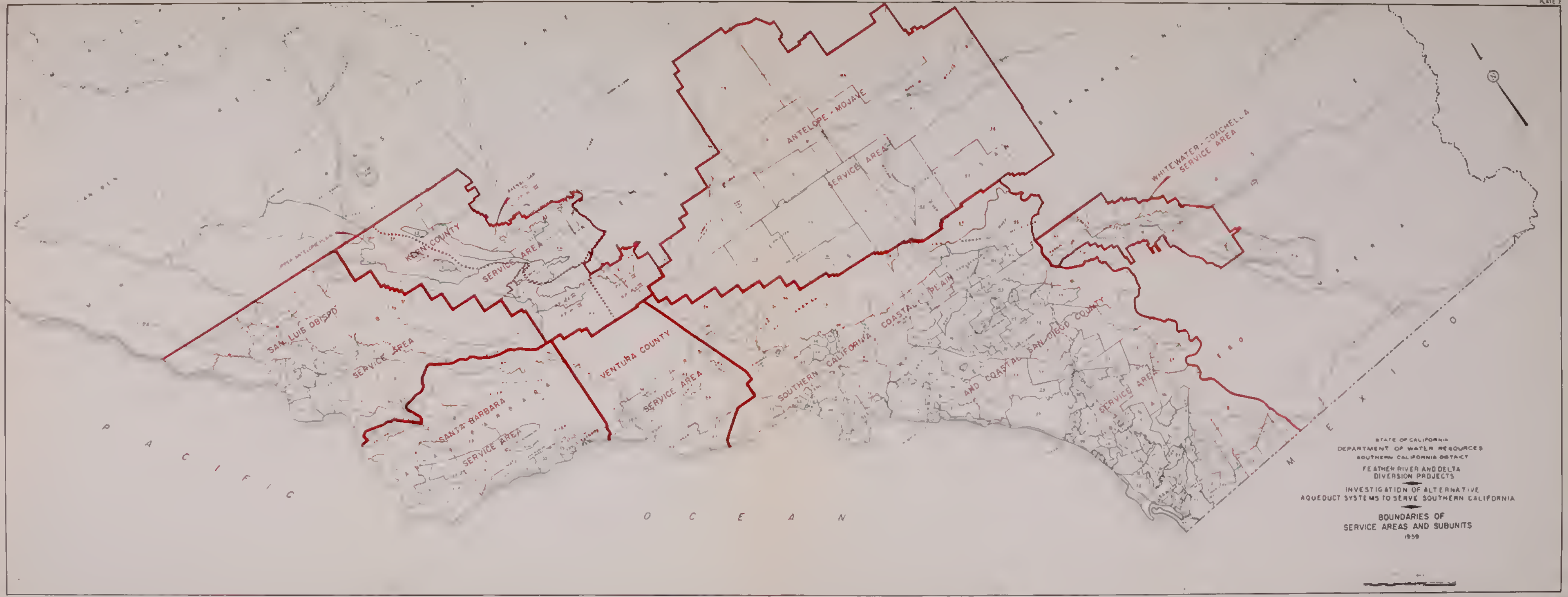
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ANTELOPE - MOJAVE SERVICE AREA
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BOUNDARIES OF
SERVICE AREAS AND SUBUNITS
1959

PLATE 3

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🟩 PRESENT IRRIGATED AREA (SEE TEXT)

⬚ MILITARY RESERVATION

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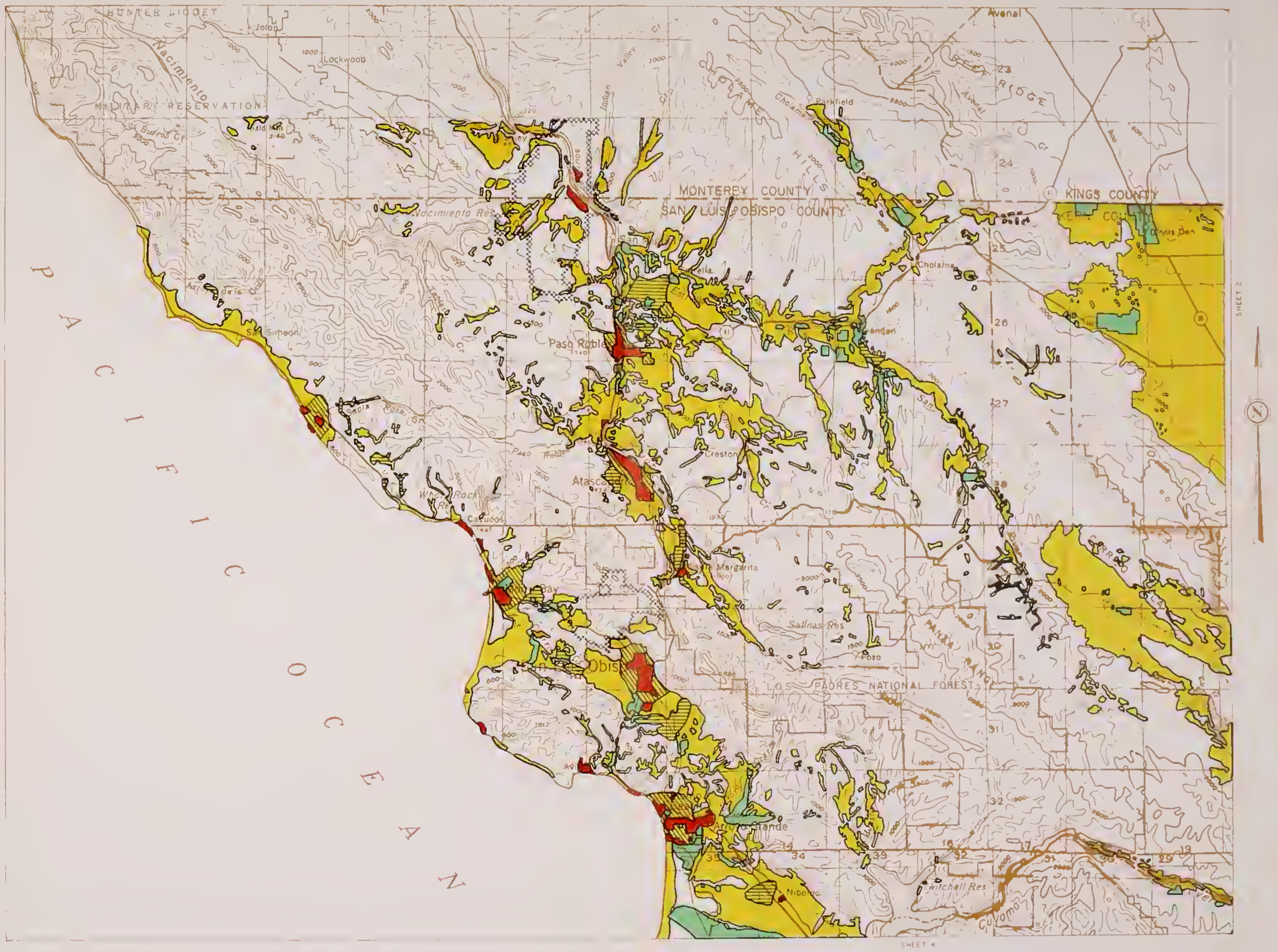
🟨 AREA CLASSIFIED AS IRRIGABLE OR HABITABLE

▨ ESTIMATED EXPANSION OF URBAN AREA, 1958 THROUGH 1980

▤ ESTIMATED EXPANSION OF IRRIGATED AREA, 1958 THROUGH 1980



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1960

SCALE OF MILES

PRESENT AND POTENTIAL LAND USE
AND
ESTIMATED EXPANSION OF URBAN AND IRRIGATED LANDS, 1958 THROUGH 1980

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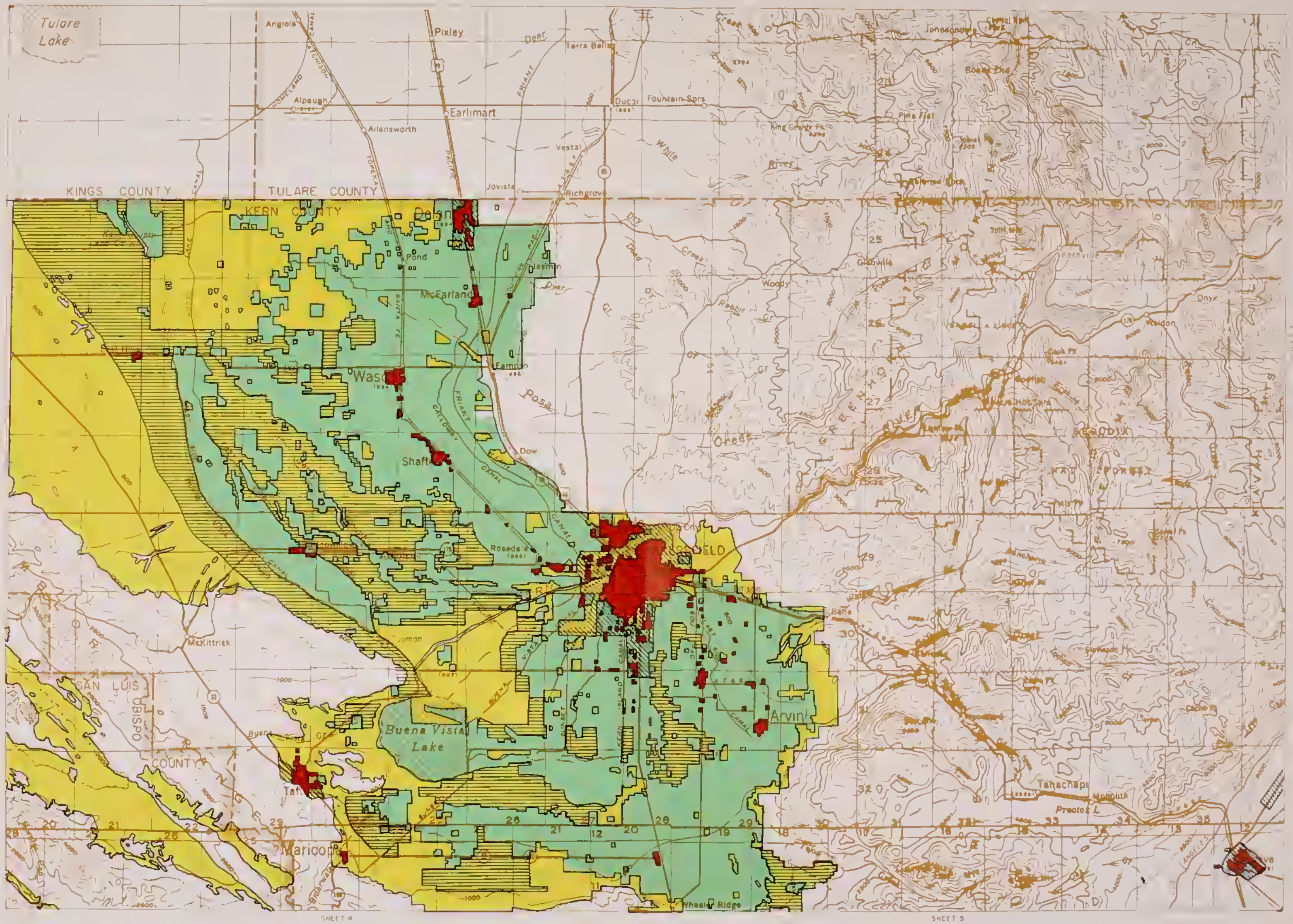

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🟨 AREA CLASSIFIED AS IRRIGABLE OR HABITABLE

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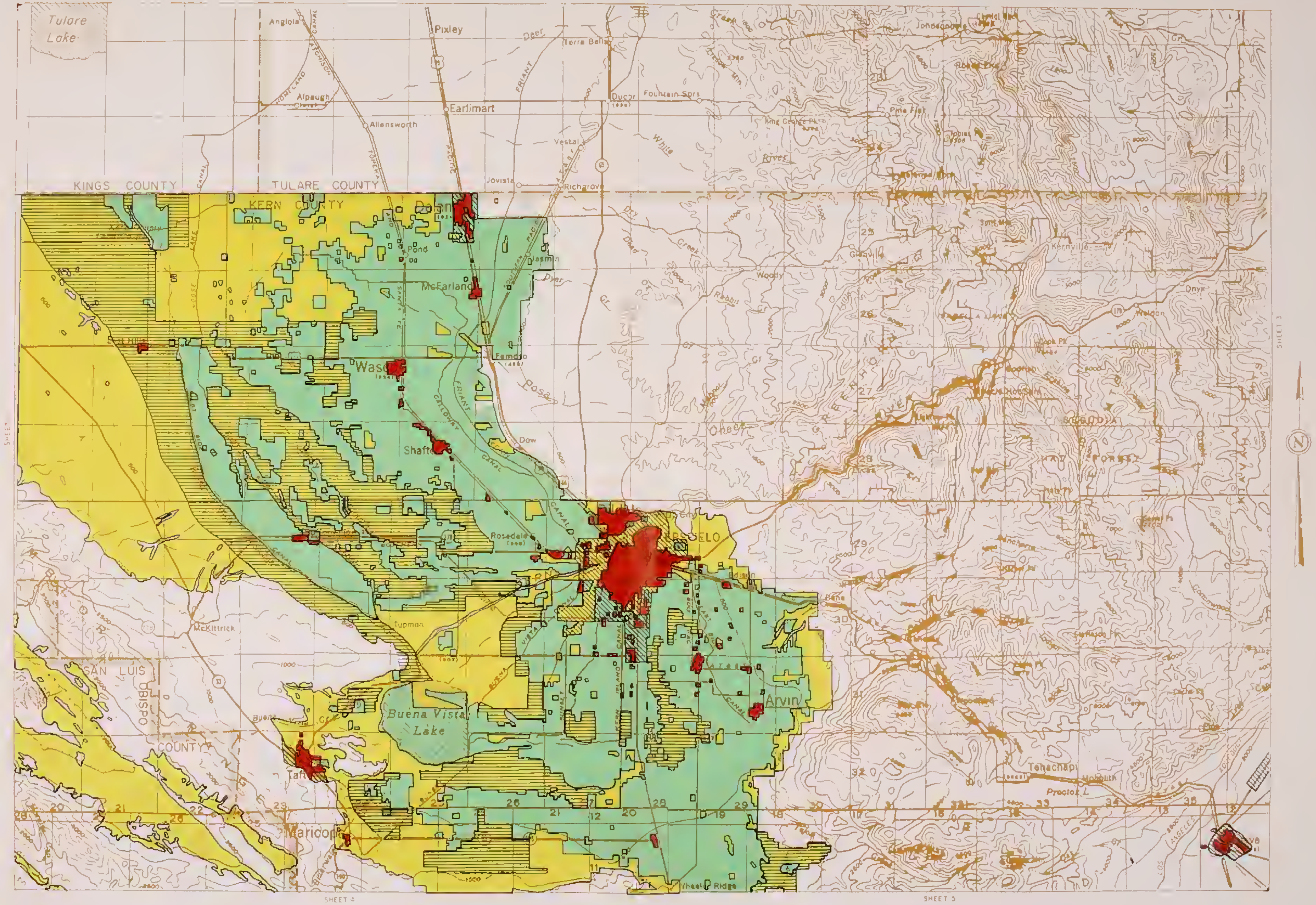

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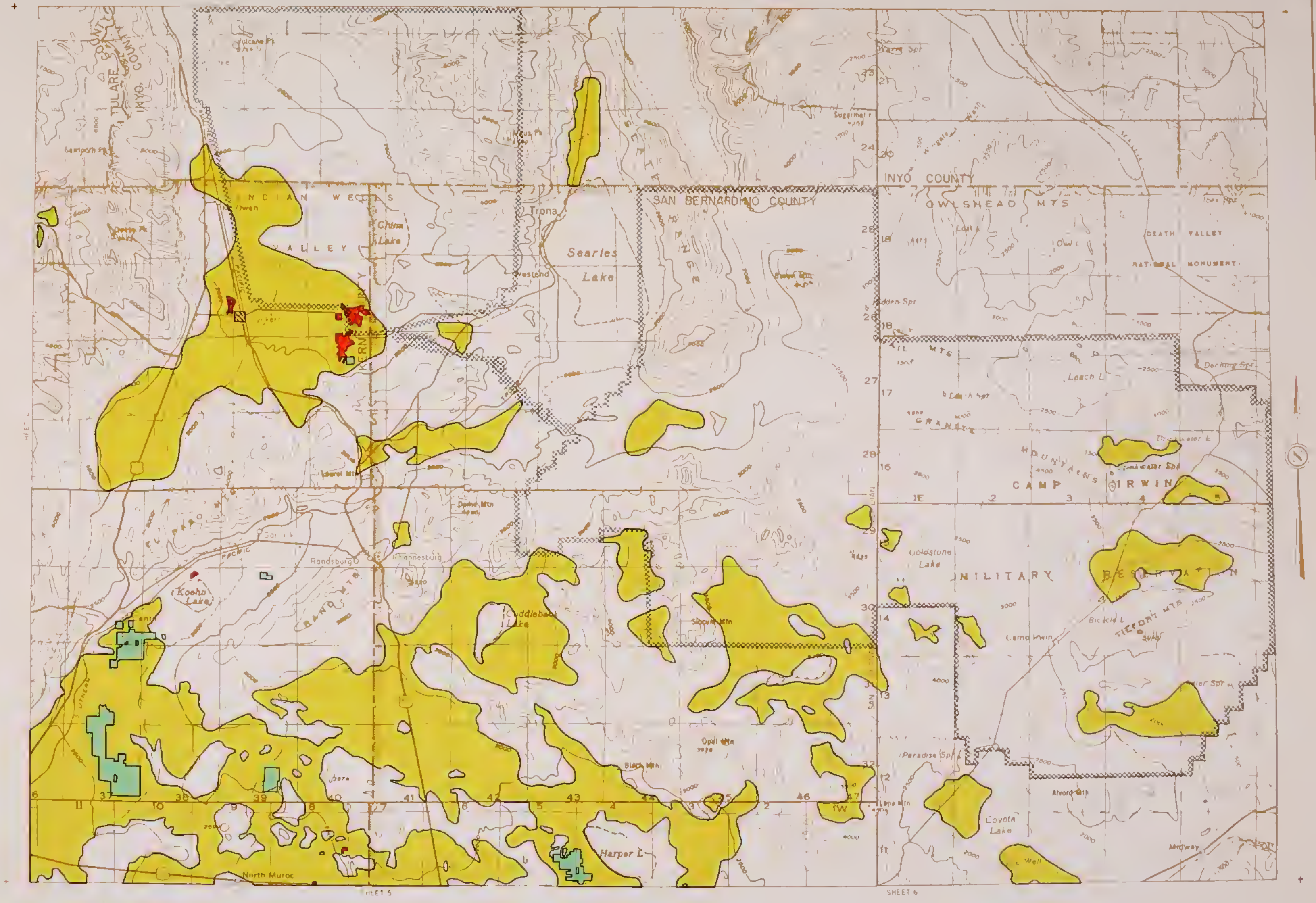

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PRESENT AND POTENTIAL LAND USE
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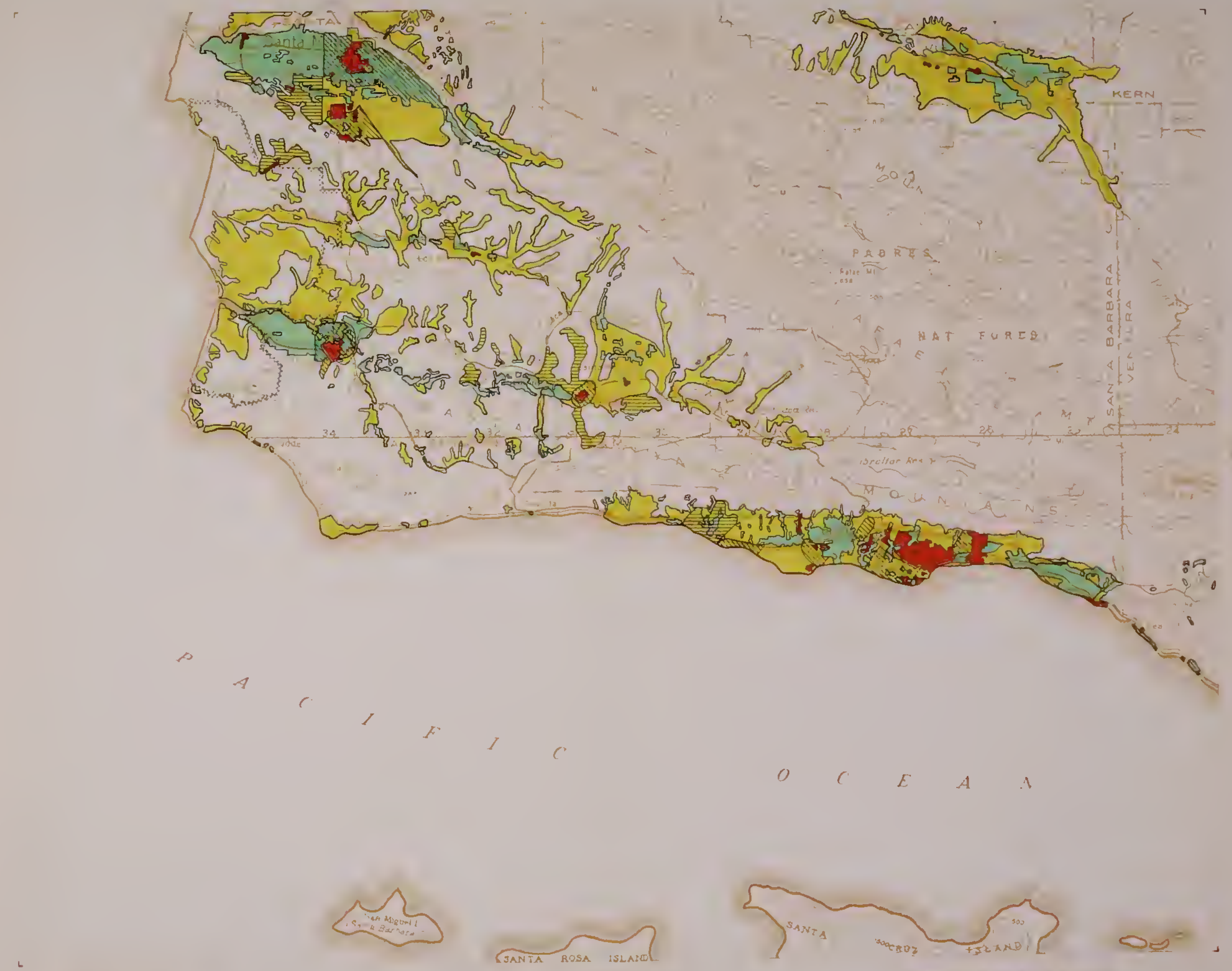

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PRESENT AND POTENTIAL LAND USE

ESTIMATED EXPANSION OF URBAN AND IRRIGATED LANDS, 1958 THROUGH 1980

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PLATE 3

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🟥	PRESENT URBAN AREA (SEE TEXT)
🟩	PRESENT IRRIGATED AREA (SEE TEXT)
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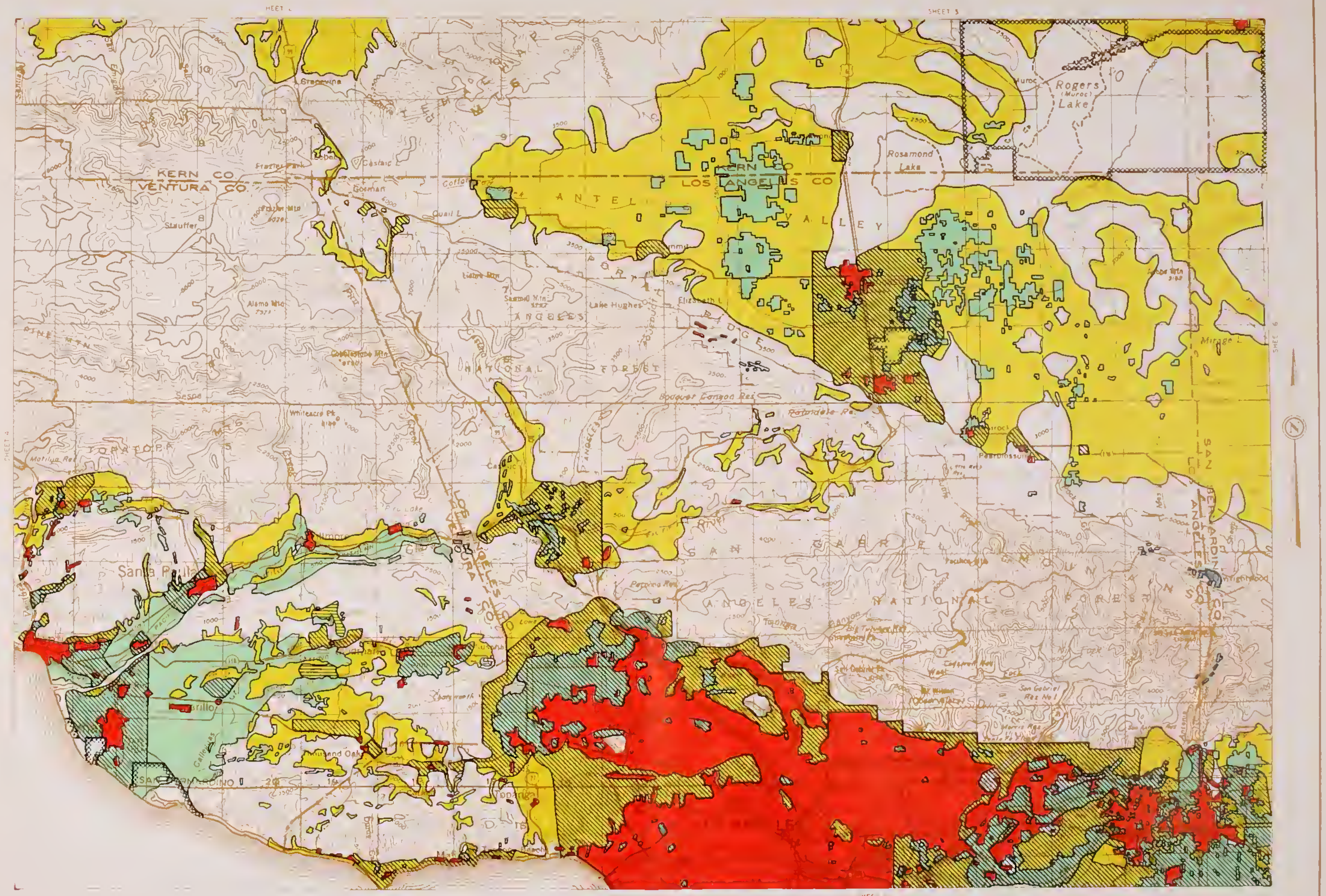

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1960

SCALE OF MILES

PRESENT AND POTENTIAL LAND USE
AND
ESTIMATED EXPANSION OF URBAN AND IRRIGATED LANDS, 1958 THROUGH 1980

SHEET 5 OF 8 SHEETS

PLATE 3

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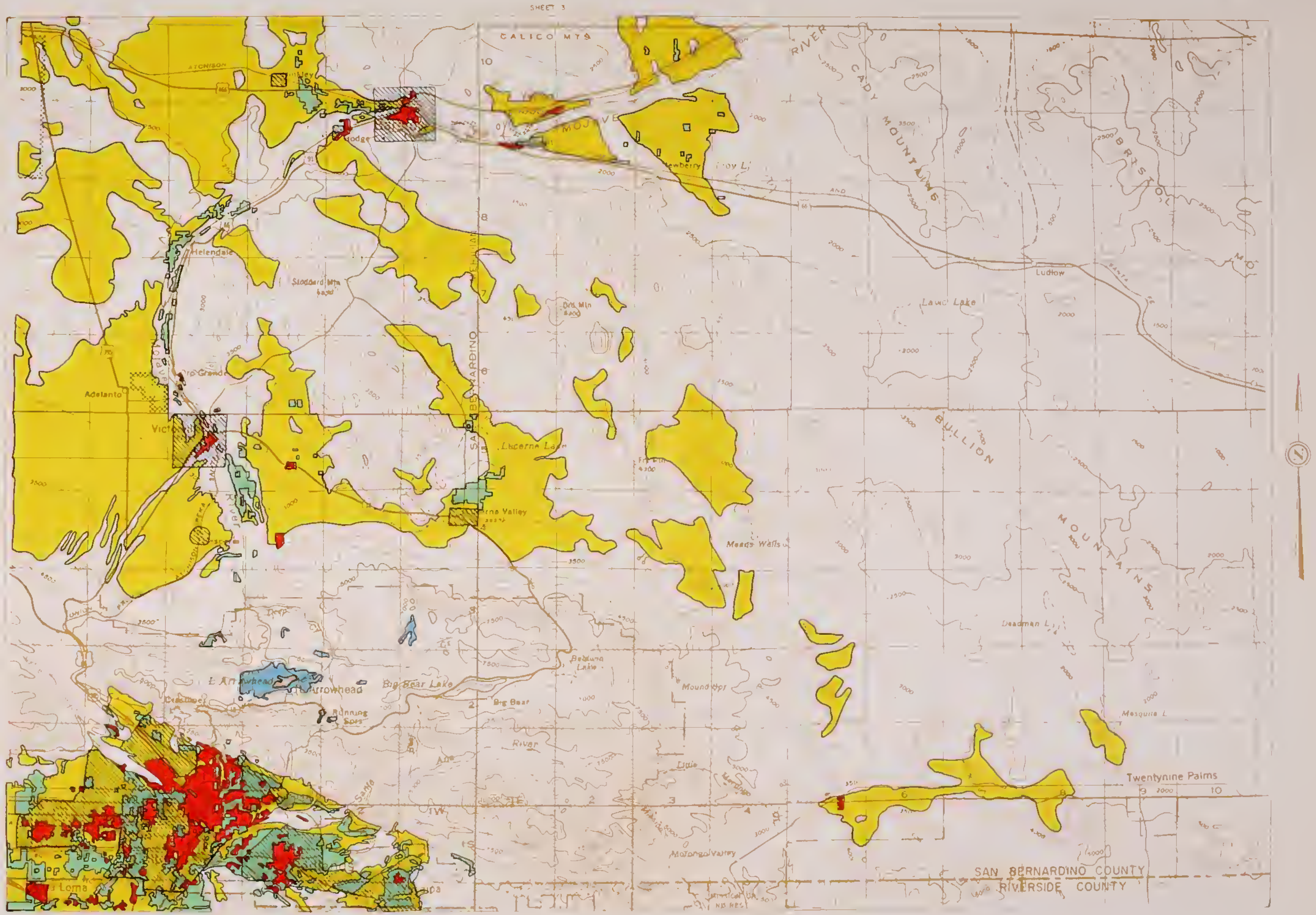

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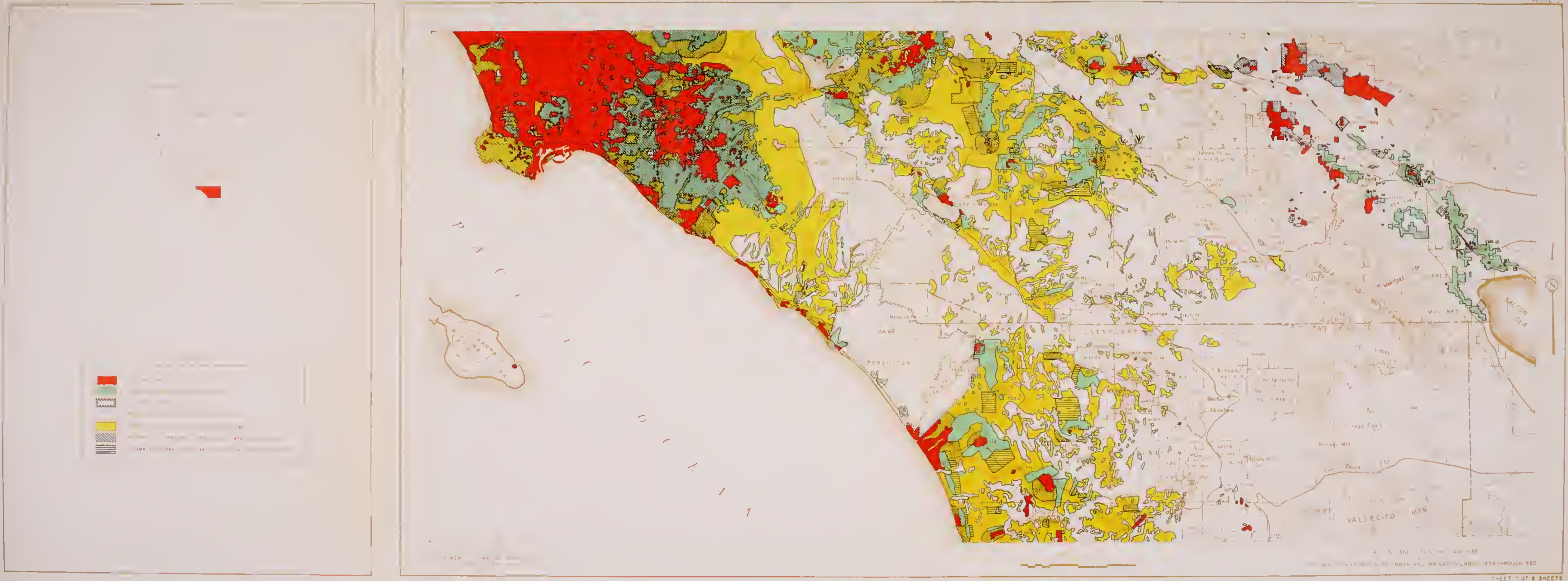

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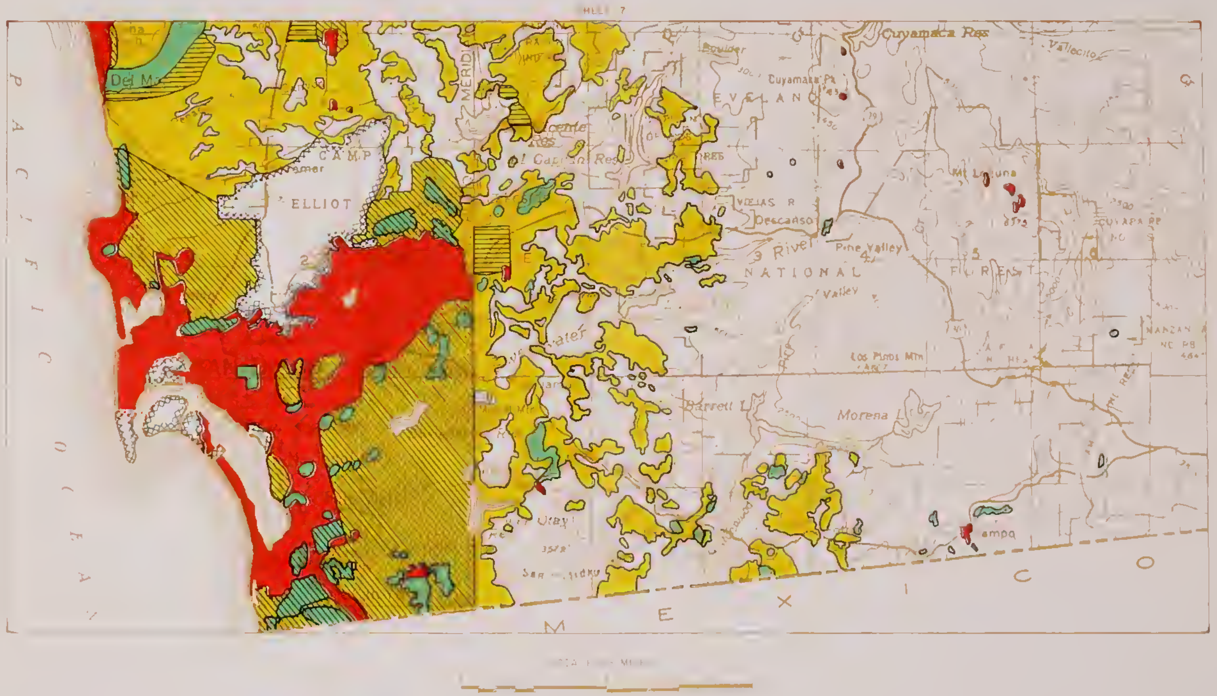

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